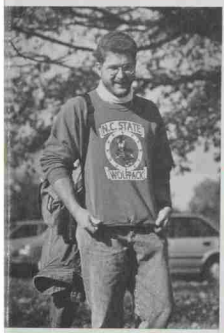




Catherine Freeman



North Carolina State University

BULLETIN

1994 Undergraduate Catalog

This catalog is intended for informational purposes only. Requirements, rules, procedures, courses and informational statements set forth herein are subject to change. Notice of changes will be conveyed to duly enrolled students and other appropriate persons at the time such changes are effected.

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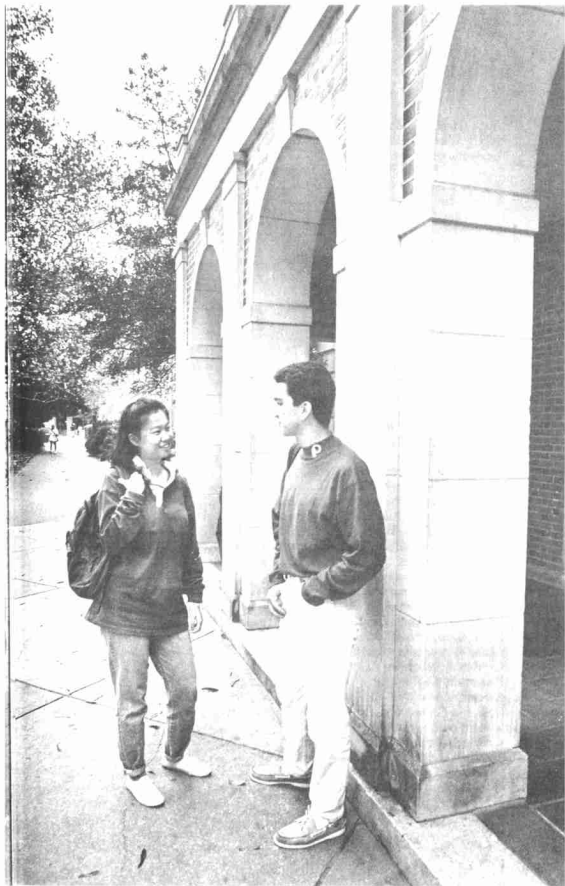


North Carolina State University

**Undergraduate
Catalog**

1994





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Above is an aerial view of the central campus of North Carolina State University viewed east to west. The strong diagonal in the foreground is Hillsborough Street, which forms the north border. In the lower left is the Memorial Tower, a prominent landmark which commemorates World War I dead.



Dr. Larry E. Monteith is North Carolina State University's eleventh chancellor.

North Carolina State University

North Carolina State University is a national center for research, teaching, and extension in the sciences and technologies, in the humanities and social sciences, and in a wide range of professional programs.

Founded March 7, 1887, by the North Carolina General Assembly under the provisions of the national Land-Grant Act, the University has marked more than a century of service to the state and the nation. Sharing the distinctive character of Land-Grant universities nationwide, NCSU has broad academic offerings, national and international linkages, and large-scale public service, extension, and research activities.

Teaching and Research

The University is organized into nine colleges, the School of Design, the Graduate School, and the Division of Undergraduate Studies. The colleges are Agriculture and Life Sciences, Education and Psychology, Engineering, Forest Resources, Humanities and Social Sciences, Management, Physical and Mathematical Sciences, Textiles, and Veterinary Medicine. These colleges and schools offer baccalaureate degrees in 89 fields, master's degrees in 80 fields, and doctoral degrees in 51 fields. Together with more than 30 research centers and institutes, these colleges and schools also support a broad spectrum of more than 1,200 scientific, technological, and scholarly research endeavors.

Extension and Outreach

Extension units carry teaching and research programs to each of North Carolina's 100 counties and the Cherokee Indian Reservation. Extension credit courses are currently delivered live and by cable, video, and satellite to 45 states and the District of Columbia, as well as to England, France, Spain, Mexico, Canada, Germany, Austria, and Venezuela.

Campus

The central campus of the University, located west of the downtown area of Raleigh, consists of 154 major buildings on 623 acres. Adjacent to the central campus are the new 940-acre Centennial Campus and the College of Veterinary Medicine campus. Nearby are research farms; biology and ecology sites; genetics, horticulture, and floriculture nurseries; forests; and Carter-Finley Stadium that together extend over 2,700 acres. Elsewhere across the state are research farms and a research forest of 82,000 acres.

Research Triangle

NCSU is one of the three Research Triangle universities along with Duke University in Durham and the University of North Carolina at Chapel Hill. Within the 30-mile triangle formed by the three universities is the 6,800 acre

Research Triangle Park, location of many public research agencies and private research centers of national and international corporations.

Faculty

The University has approximately 6,500 employees. Faculty and other academic personnel total 2,775, including 1,917 graduate faculty. Among the many honors and recognitions received by members of the faculty are seven memberships in the National Academy of Science and four in the National Academy of Engineering, 37 named professorships, 19 University distinguished professorships, 73 Alumni Distinguished Undergraduate Professors, and currently over 260 members of the Academy of Outstanding Teachers.

Students

In the 1992 fall semester, the University's headcount enrollment totaled 27,157. Included in this number were 18,694 students in undergraduate degree programs, 4,673 in graduate degree programs, and 3,790 Lifelong Education students. The combined undergraduate and graduate enrollments by college were: Agriculture and Life Sciences - 3,767; Design - 618; Education and Psychology - 1,656; Engineering - 7,016; Forest Resources - 823; Humanities and Social Sciences - 3,615; Management - 2,156; Physical and Mathematical Sciences - 1,438; Textiles - 993; and Veterinary Medicine - 336. There were 400 students in the University Undesignated Program and 142 in the University Transition Program. The student population included 2,461 African-American students; 1,235 other minority students, and 10,641 female students. Students at the University come from 49 states, three United States territories, and approximately 92 foreign countries. The international enrollment is a distinctive feature of the institution as more than 1,200 international students give the campus a cosmopolitan atmosphere.

Visual and Performing Arts

Each year the University provides its students with a wide range of opportunities for participation in, and exposure to, the arts. The Visual Arts Center hosts changing exhibitions of contemporary art and design and houses the University's collections of ceramics, photography, and textiles. The Music Department sponsors visiting artists in short-term residencies, faculty recitals, and a large number of student ensembles that perform both on and off campus. Thompson Theatre is the University's producing theatre. The Crafts Center provides opportunities for hands on experience in crafts courses such as pottery, wood working, fibers, and photography. Center Stage Stewart Theatre annually presents 35 or more professional events. The Dance Program provides both credit and non credit opportunities with dance groups and dance courses. The Films Program provides an international film series, a series of independent experimental film makers, and popular commercial films. The Friends of the College Program presents five to seven major national and international classical cultural concerts each year.

Athletics

The University's "Wolfpack" athletic teams are well-known nationally. The men's basketball team won national championships in 1974 and in 1983 and holds 10 Atlantic Coast Conference titles. The football team has been the Atlantic Coast Conference champion five times, co-champion twice, and has played in 14 bowl games. The Wolfpack women's cross country team won national championships in 1979 and 1980 along with 10 ACC crowns, while the men's and women's soccer teams have both advanced to the NCAA's "final four" in the last five years. The women's basketball team, under the direction of 1988 United States Olympic gold medal winning coach Kay Yow, has played in 11 of 15 ACC title games. The wrestling team has won nine ACC titles while the men's swim team has claimed 24 conference championships. Providing additional color and spirit for the games, the cheerleading squad was recognized three times as national champions. Numerous individual NCSU athletes have won NCAA titles, national championships, and international honors, including medals in the last four Olympic Games in which the United States has competed.

Associations

The University is a member of the National Association of State Universities and Land-Grant Colleges, the American Council on Education, the American Council of Learned Societies, the Association of Governing Boards of Universities and Colleges, the Oak Ridge Associated Universities, the International University Consortium for Telecommunications in Learning, the North Carolina Association of Colleges and Universities, and the Cooperating Raleigh Colleges.

Affirmative Action

NCSU is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, sex, age, or disability. Moreover, NCSU is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of African American students.

ACCREDITATION

North Carolina State University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award associate, baccalaureate, master's, and doctoral degrees. In addition, many of the University's professional programs and departments are accredited by national professional associations, including:

- Accreditation Board for Engineering and Technology
- American Association for Accreditation of Laboratory Animal Care
- American Chemical Society
- American Veterinary Medical Association
- Computer Science Accreditation Commission
- Council on Social Work Education
- Landscape Architectural Accrediting Board

National Architectural Accrediting Board
National Association of Schools of Public Affairs and Administration
National Council for Accreditation of Teacher Education
National Recreation and Park Association
Society of American Foresters
Society of Wood Science and Technology

NONDISCRIMINATION POLICY

NCSU is dedicated to equality of opportunity within its community. Accordingly, NCSU does not practice or condone discrimination, in any form, against students, employees, or applicants on the grounds of race, color, national origin, religion, sex, age, or disability.

NCSU commits itself to positive action to secure equal opportunity regardless of those characteristics.

NCSU supports the protection available to members of its community under all applicable Federal laws, including Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 799A and 845 of the Public Health Service Act, the Equal Pay and Age Discrimination Acts, the Rehabilitation Act of 1973, the Vietnam Veteran's Readjustment Assistance Act of 1974, and Executive Order 11246.

For information concerning these provisions, contact:

Lawrence M. Clark
Affirmative Action Officer
201 Holladay Hall
Box 7101
North Carolina State University
Raleigh, North Carolina 27695-7101
Phone: (919) 515-3409 or 515-3148

NCSU Administration and Offices

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Chancellor for Facilities
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Information Services
Lucy C. Coulbourn, Director

ATHLETICS
William T. Turner, Director

Academic Calendar

SPRING SEMESTER, 1993

January	6	Wednesday	First day of classes
January	13	Wednesday	Last day to add a course without permission of instructor
January	18	Monday	Holiday (Martin Luther King Day)
January	21	Thursday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund; last day for undergraduate students to drop below 12 hours. <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
February	4	Thursday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
February	17	Wednesday	Academic Difficulty Reports due
February	26	Friday	Spring vacation begins at 10:15 p.m.
March	8	Monday	Classes resume at 8:05 a.m. (8:35 a.m. Centennial Campus)
March	12	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
March	22	Monday	Registration advising begins for 1993 summer sessions and fall semester
March	27	Saturday	TRACS registration opens
April	9	Friday	Holiday (Good Friday)
April	23	Friday	Last day of classes
April	26	Mon-Tues	Final Examinations
May	4		
May	8	Saturday	Commencement

SUMMER SESSIONS, 1993

First Session

May	25	Tuesday	First day of classes
May	26	Wednesday	Last day to add a course without permission of instructor
May	31	Monday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund. <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
June	4	Friday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
June	11	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
June	25	Friday	Last day of classes
June	28 29	Mon-Tues	Final Examinations

Second Session

July	6	Tuesday	First day of classes
July	7	Wednesday	Last day to add a course without permission of instructor
July	12	Monday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund. <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
July	16	Friday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
July	23	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
August	6	Friday	Last day of classes
August	9-10	Mon Tues	Final Examinations

FALL SEMESTER, 1993

August	25	Wednesday	First day of classes
September	1	Wednesday	Last day to add a course without permission of instructor
September	6	Monday	Holiday (Labor Day)
September	9	Thursday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund; last day for undergraduate students to drop below 12 hours. <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
September	23	Thursday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
October	8	Friday	Academic Difficulty Reports due
October	15	Friday	Fall vacation begins at 1:15 p.m. (1:45 p.m. Centennial Campus)
October	20	Wednesday	Classes resume at 8:05 a.m. (8:35 a.m. Centennial Campus)
October	25	Monday	Registration advising begins for 1994 spring semester
October	27	Wednesday	Honors convocation (no classes until 12:15 p.m.) (12:45 p.m. Centennial Campus)
October	29	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
November	23	Tuesday	Thanksgiving vacation begins at 10:00 p.m.
November	29	Monday	Classes resume at 8:05 a.m. (8:35 a.m. Centennial Campus)
December	10	Friday	Last day of classes
December	13 21	Mon-Tues	Final Examinations
December	22	Wednesday	Fall Graduation Exercise

SPRING SEMESTER, 1994

January	12	Wednesday	First day of classes
January	17	Monday	Holiday (Martin Luther King Day)
January	20	Thursday	Last day to add a course without permission of instructor
January	27	Thursday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund; last day for undergraduate students to drop below 12 hours. <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
February	10	Thursday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
February	23	Wednesday	Academic Difficulty Reports due
March	11	Friday	Spring vacation begins at 10:15 p.m.
March	21	Monday	Classes resume at 8:05 a.m. (8:35 a.m. Centennial Campus)
March	25	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
March	28	Monday	Registration advising begins for 1994 summer sessions and fall semester
April	1	Friday	Holiday (Good Friday)
April	29	Friday	Last day of classes
May	2-10	Mon-Tues	Final Examinations
May	14	Saturday	Commencement

SUMMER SESSIONS, 1994

First Session

May	24	Tuesday	First day of classes
May	25	Wednesday	Last day to add a course without permission of instructor
May	30	Monday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
June	3	Friday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
June	10	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
June	24	Friday	Last day of classes
June	27-28	Mon-Tues	Final Examinations

Second Session

July	5	Tuesday	First day of classes
July	6	Wednesday	Last day to add a course without permission of instructor

July	11	Monday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
July	15	Friday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
July	22	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
August	5	Friday	Last day of classes
August	8-9	Mon-Tues	Final Examinations

FALL SEMESTER, 1994

August	24	Wednesday	First day of classes
August	31	Wednesday	Last day to add a course without permission of instructor
September	5	Monday	Holiday (Labor Day)
September	8	Thursday	Last day to register (includes payment of tuition and fees) or to add a course; last day to withdraw or drop a course with a refund; last day for undergraduate students to drop below 12 hours. <i>The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m.</i>
September	22	Thursday	Last day to withdraw or drop a course at the 400 level or below without a grade; last day to change from credit to audit at the 400 level or below; last day to change to credit only
October	7	Friday	Academic Difficulty Reports due
October	14	Friday	Fall vacation begins at 1:15 p.m. (1:45 p.m. Centennial Campus)
October	19	Wednesday	Classes resume at 8:05 a.m. (8:35 a.m. Centennial Campus)
October	24	Monday	Registration advising begins for 1995 spring semester
October	26	Wednesday	Honors convocation (no classes until 12:15 p.m.) (12:45 p.m. Centennial Campus)
October	28	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade; last day to change from credit to audit at the 500 or 600 level
November	22	Tuesday	Thanksgiving vacation begins at 10:00 p.m.
November	28	Monday	Classes resume at 8:05 a.m. (8:35 a.m. Centennial Campus)
December	9	Friday	Last day of classes
December	12-20	Mon-Tues	Final Examinations
December	21	Wednesday	Fall Graduation Exercise

This calendar is subject to periodic review and revision. Please check with the University Registrar to determine if changes have been made.

Academic Fields of Study and Degrees

NCSU offers more than 89 fields of study at the undergraduate level. These fields of study include comprehensive academic programs leading to various baccalaureate degrees. Some are options within degree programs, such as the Writing Editing Option within the B.A. in English or the Construction Option within the B.S. in Engineering. The Multidisciplinary Studies Program in Humanities and Social Sciences provides opportunities for creating additional fields of study to meet the specialized needs of particular students.

The following are the undergraduate fields of study available at NCSU:

Agriculture

- Agronomy
- Animal Science
- Food Science
- Horticultural Science
- Poultry Science

Business

- Accounting
- Agricultural Business Management
- Business Management

Biological Sciences

- Biochemistry
- Biological Sciences
- Botany
- Microbiology
- Zoology

Design

- Architecture
- Environmental Design
- Landscape Architecture
- Industrial Design
- Graphic Design

Education (including teacher certification)

- Agricultural Education (grades 9-12)
- Education, General Studies
- English (grades 9-12)
- French Language and Literature (grades 9-12)
- Health Occupations Education (grades 9-12 or postsecondary)
- Marketing Education for Teachers (grades 9-12)

- Mathematics Education (grades 6-9 or 9-12)
- Middle Grades Education (grades 6-9)
- Science Education (grades 6-9 or 9-12)
- Social Studies (grades 9-12)
- Spanish Language and Literature (grades 9-12)
- Technical Education (postsecondary)
- Technology Education (grades 9-12)
- Vocational Industrial Education (grades 9-12)

Engineering

- Aerospace Engineering
- Biological and Agricultural Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Construction Engineering
- Construction Management
- Electrical Engineering
- Engineering
- Environmental Engineering
- Furniture Manufacturing and Management
- Industrial Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Nuclear Engineering
- Textile Engineering

Forestry and Natural Resources

- Fisheries and Wildlife Sciences
- Forestry
- Natural Resources

Humanities

Communication
 English
 French Language and Literature
 History
 Philosophy
 Spanish Language and Literature
 Writing Editing

Individualized Program

Multidisciplinary Studies
 (Humanities and Social Sciences)

Mathematics and Related Sciences

Applied Mathematics
 Computer Science
 Mathematics
 Statistics

Medical and Veterinary Sciences

Medical Technology
 Pre-dental
 Pre medical
 Pre veterinary

Parks, Recreation, and Tourism

Parks, Recreation, and Tourism
 Management

Physical Sciences

Chemistry
 Geology
 Meteorology
 Physics

Psychology

Human Resource Development
 Psychology

Social Sciences

Agricultural Economics
 Applied Sociology
 Criminal Justice
 Economics
 Political Science
 Social Work
 Sociology

Textiles

Textile Chemistry
 Textile and Apparel Management
 Textile Materials Science
 Textiles

Wood Science

Pulp and Paper Science and
 Technology
 Wood Products

PRE-PROFESSIONAL PROGRAMS

Pre-Law Program. Law schools neither prescribe nor recommend a particular undergraduate curriculum for prospective candidates. A student may prepare for law school by a careful use of electives within any of the baccalaureate curricula offered by the ten colleges with undergraduate programs. There are two faculty advisers designated to assist pre-law students with selection of appropriate electives and concentrations. They also advise the Pre Law Student's Association which is open to all interested students. This group invites outside speakers to make presentations about law schools and careers in the law. In addition, the group makes at least one and sometimes two visits per year to local law schools where the students can attend classes and visit with directors of admissions. For further information, consult Dr. D.L. Baumer, 114 Nelson Hall, (919) 515 6950, or Dr. B. B. Levenbook, 106 Winston Hall, (919) 515-3214.

Pre-Medicine, Pre-Dentistry, and Pre-Optometry Programs. Students preparing for medical, dental, or optometry schools major in areas such as the life sciences or physical sciences (frequently biology, chemistry, biochemistry, or zoology), the humanities or social sciences (frequently psychology), or engineering. Health science professional schools are more interested in the quality and scope of the applicants' education than in their academic major.

The Department of Zoology offers a pre-medical/pre-dental curriculum leading to a baccalaureate degree in zoology. The University Review Committee for

Pre professional Applicants in Health Sciences assists students in preparing applications and in providing evaluations to professional schools. For further information, consult Dr. W. C. Grant, Agriculture and Life Science, chairman of the Review Committee, or the pre-professional health science advisers in the several colleges: Dr. S. A. Rajala, Engineering; Dr. M. L. Miles, Physical and Mathematical Sciences; and Dr. J. N. Wall, Jr., Humanities and Social Sciences.

Pre-Veterinary Program. A pre-veterinary program of study is offered by the College of Agriculture and Life Sciences which may be taken by students majoring in animal science, poultry science, zoology, or biological sciences as well as in many other science curricula, such as biochemistry or chemistry. If a student is accepted to veterinary medical school before completion of his or her undergraduate degree, some course credits may be transferable from the veterinary program toward completion of the Bachelor of Science degree. Arrangements for this procedure should be made with the degree-granting school or department prior to entering veterinary college. For further information, contact the Academic Programs Office of the College of Agriculture and Life Sciences, (919) 515 2614 or the Admissions Office for Veterinary Students of the College of Veterinary Medicine, (919) 829-4205, for general information concerning admission to the Doctor of Veterinary Medicine programs at NCSU.

UNDERGRADUATE MINORS

The following undergraduate minors are available to all undergraduate degree students at NCSU:

Accounting; African American Studies; Agricultural Business Management; Agricultural Economics; Agricultural Systems Technology; Animal Science; Anthropology; Applied Sociology; Arts Studies; Biological Sciences; Botany; Business Management; Chinese Studies; Classical Greek; Classical Studies; Cognitive Science; Comparative Literature; Computer Programming; Design; Economics; English; Entomology; Environmental Science; Film Studies; Food Science; Forest Management; French; Genetics; Geology; German; Graphic Communications; History; Horticultural Science; Industrial Engineering; International Studies; Italian Studies; Japanese; Journalism; Linguistics; Materials Science and Engineering; Mathematics; Meteorology; Microbiology; Nutrition; Parks, Recreation, and Tourism Management; Philosophy; Physical Education (Coaching Emphasis); Physics; Political Science; Psychology; Pulp and Paper Technology; Religious Studies; Russian Studies; Science, Technology, and Society; Social Work; Sociology; Soil Science; Spanish; Statistics; Technology Education; Textile Chemistry; Theatre; Women's Studies; Wood Products; and Zoology.

AGRICULTURAL INSTITUTE

Admission to this two-year program requires high school graduation and a letter of recommendation. The program does not carry college credit. An Associate of Applied Science degree is awarded. Fields of study are:

Agribusiness Management
Agricultural Pest Control
Field Crops Technology
Food Processing, Distribution, and Service
General Agriculture
Livestock Management and Technology (General Livestock, Dairy, and Swine Options)
Ornamentals and Landscape Technology
Turfgrass Management

UNDERGRADUATE DEGREES AND DEGREE OPTIONS

Bachelor of:

School of Design

architecture (fifth year program); environmental design; environmental design in architecture; environmental design in landscape architecture; environmental design in industrial design; and environmental design in graphic design

College of Humanities and Social Sciences

social work

Bachelor of Science in:

College of Agriculture and Life Sciences

(Business) agricultural business management
(Science) agricultural economics; agricultural systems technology; animal science; applied sociology (including option in criminal justice); biochemistry; biological sciences; botany; fisheries and wildlife sciences; food science; horticultural science; medical technology; natural resources; poultry science; pre-veterinary option; and zoology (including options in pre-dental and pre-medical)
(Technology) agronomy; animal science; biological and agricultural engineering; food science; horticultural science; and poultry science

College of Education and Psychology

agricultural education; education, general studies; health occupations teacher education; marketing education for teachers; mathematics education; middle grades education; science education; technical education; technology education; and vocational industrial education

College of Engineering

aerospace engineering; biological and agricultural engineering; chemical engineering; civil engineering (including construction option); computer engineering; computer science; construction management; electrical engineering; engineering; environmental engineering; furniture manufacturing and management; industrial engineering; materials science and engineering; mechanical engineering; and nuclear engineering

College of Forest Resources

forestry; natural resources; parks, recreation, and tourism management; pulp and paper science and technology; and wood products

College of Humanities and Social Sciences

English; history; philosophy; and political science

College of Management

economics

College of Physical and Mathematical Sciences

chemistry; geology; mathematics; meteorology; natural resources; physics; and statistics

College of Textiles

textile chemistry; textile engineering; textile and apparel management; textile materials science; and textiles

Bachelor of Arts in:

College of Education and Psychology

psychology (including option in human resource development)

College of Humanities and Social Sciences

communication; English (including options in teacher education and writing-editing); French (including an option in teacher education); history; multidisciplinary studies in humanities and social sciences; philosophy; political science (including an option in criminal justice); social studies education option (in history, political science, or sociology); sociology (including an option in criminal justice); and Spanish (including an option in teacher education)

College of Management

accounting; business management; and economics

College of Physical and Mathematical Sciences

chemistry; and geology

PROFESSIONAL DEGREES

College of Engineering

Chemical Engineer; Civil Engineer; Electrical Engineer; Industrial Engineer; Materials Engineer; Mechanical Engineer; and Nuclear Engineer

College of Veterinary Medicine

Doctor of Veterinary Medicine

GRADUATE DEGREES

Master of:

agriculture; architecture; biological and agricultural engineering; biomathematics; chemical engineering; chemistry; civil engineering; computer engineering; computer science; economics; education; electrical engineering; engineering (off-campus program only); forestry; industrial engineering; integrated manufacturing systems engineering; landscape architecture; life sciences; materials science and engineering; mechanical engineering; nuclear engineering; product design; public administration; parks, recreation, and tourism management; sociology; statistics; technology for international development; textiles; toxicology; wildlife biology; and wood and paper science

Master of Arts in:

economics; English; history; liberal studies; political science; and public history

Master of Science in:

adult and community college education; aerospace engineering; agricultural economics; agricultural education; animal science; applied mathematics; biochemistry; biological and agricultural engineering; biomathematics; botany; chemical engineering; chemistry; civil engineering; computer engineering; computer science; crop science; curriculum and instruction; ecology; educational administration and supervision; electrical engineering; entomology; food science; forestry; genetics; guidance and personnel services; health occupations teacher education; higher education administration; horticultural science; industrial engineering; management; marine, earth and atmospheric sciences; materials science and engineering; mathematics; mathematics education; mechanical engineering; microbiology; middle grades education; nuclear engineering; nutrition; occupational education;

operations research; physics; physiology; plant pathology; poultry science; psychology; parks, recreation and tourism management; rural sociology; science education; soil science; special education; statistics; technical communication; technology education; textile chemistry; textiles; toxicology; training and development; veterinary medical sciences; vocational industrial education; wildlife biology; wood and paper science; and zoology

Doctor of Philosophy in:

aerospace engineering; animal science; applied mathematics; biochemistry; biological and agricultural engineering; biomathematics; botany; chemical engineering; chemistry; civil engineering; crop science; computer engineering; computer science; counselor education; economics; electrical engineering; entomology; fiber and polymer science; food science; forestry; genetics; horticultural science; industrial engineering; marine, earth and atmospheric sciences; materials science and engineering; mathematics; mathematics education; mechanical engineering; microbiology; nuclear engineering; nutrition; operations research; physics; physiology; plant pathology; psychology; science education; sociology; soil science; statistics; textile technology and management; toxicology; veterinary medical sciences; wood and paper science; and zoology

Doctor of Education in:

adult and community college education; curriculum and instruction; educational administration and supervision; guidance and personnel services; higher education administration; industrial arts education; and occupational education

Consult the *Graduate Catalog* for further information on graduate programs and admissions procedures.

Natural Resources Curricula

The area of "natural resources" covers broad, technically complex and interrelated systems of physical, biological, economic, and political areas. Rising demand for use of all natural resources, from recreational opportunities to minerals, from mountain forests to the ocean depths, creates difficult environmental, economic, and ethical questions.

BACHELOR OF SCIENCE IN NATURAL RESOURCES

A new degree program in Natural Resources was established in 1992. It is designed to address the interdisciplinary nature of natural resource problems and to prepare students for entry level positions in government or private industry consulting firms or for graduate school. The program consists of a common core and concentrations developed by participating academic departments. The 84-hour core meets all University general education requirements, but it emphasizes foundation coursework in the natural sciences - biology, chemistry, earth sciences, and associated mathematics and statistics. Also in the core are a freshman introductory course and a senior capstone course designed specifically for natural resource majors. Currently, there are seven natural resource concentrations being offered by four departments, but others may be added in the future in response to student interest and employment opportunities.

Concentrations

Ecosystem Assessment (Department of Forestry, 44 hours)

Policy and Administration (Department of Forestry, 45 hours)

Geological Resources (Department of Marine, Earth and Atmospheric Sciences, 36 or 37 hours)

Marine and Coastal Resources (Department of Marine, Earth and Atmospheric Sciences, 36 hours)

Soil Resources (Department of Soil Science, 42 hours)

Soil and Water Resource Systems (Department of Soil Science, 43 hours)

Economics and Management (Department of Agricultural and Resource Economics, 36 hours)

In addition, the following curricula address issues related to natural resources:

College of Agriculture and Life Sciences

Agricultural and Resource Economics

Agronomy

Soil Science Concentration

Botany

Biological and Agricultural Engineering

Biological Sciences

Fisheries and Wildlife

Horticulture (Landscape Horticulture)

Zoology

School of Design

Environmental Design in Landscape Architecture

College of Engineering

Civil Engineering

College of Forest Resources

Forestry

Management Concentration

Parks, Recreation, and Tourism Management

Arts Studies

NC SU offers a rich variety of courses in the history, analysis, and production of the arts—dance, film, music, theatre, visual arts. Many of these courses are open to students without prerequisite. Offered by 13 departments in four different colleges of the University, they are listed under “Arts Studies” in the “Course Descriptions” section of the catalog and described in detail under their departmental prefix.

In addition to these courses, most of which focus on a single art form, the Division of Multidisciplinary Studies offers special topics courses (MDS 295, 494, 495) each of which deals with several arts media or with the arts in connection with science and technology; information about these courses, which change each year, is available from the Office of Multidisciplinary Studies.

For students who want to concentrate in Arts Studies, an academic minor is available. In addition, there are minors in Theatre, Design, and Film Studies. Students may also major in Multidisciplinary Studies with a concentration in Arts Studies. This program makes it possible for students to prepare themselves, for example, for graduate programs in art conservation or medical illustration.

Opportunities for students to participate in arts activities include many instrumental and choral organizations, student productions in Thompson Theatre, craft instruction and facilities in the Craft Center, and the exhibitions of the Visual Arts Program. These activities, many of which are integrated with academic courses, are described in more detail under “Student Activities” in this section of the catalog.

Honors and Scholars Programs

UNIVERSITY SCHOLARS PROGRAM

The University Scholars Programs are designed to address the needs of students who are academically successful, highly motivated, and committed to excellence and intellectual exploration. Coordinated between the Division of Student Affairs, the University Undesignated Program, the School of Design and the Colleges of Agriculture and Life Sciences, Education and Psychology, Engineering, Forest Resources, Humanities and Social Sciences, Management, Physical and Mathematical Sciences, and Textiles, the University Scholars Programs provide a variety of unique educational experiences for qualified undergraduates. Students are invited to participate on the basis of selection criteria specific to each school.

Participants in the University Scholars Programs have the opportunity to enroll in sections of academic courses reserved for Scholars. These courses, which are taught by distinguished faculty members, encourage the development of a learning environment that is richly invigorating and intellectually stimulating.

Scholars also attend a weekly Forum Series which includes guest speaker presentations and discussions on issues of contemporary social and educational significance. Through the University Scholars Programs, NCSU Scholars are members and participate in the activities of the North Carolina Honors Association, the Southern Regional Honors Council and the National Collegiate Honors Council. Extracurricular opportunities and educational field trips are also made available to broaden the personal and cultural horizons of participants. In addition to these activities, there are specific academic expectations defined by the respective schools or colleges.

For more information contact the Coordinator of University Scholars Programs, 102 Sullivan Hall, (919) 515-2353, or the office of the appropriate college dean.

HONORS PROGRAMS

Honors programs are offered by the academic colleges and individual departments. Honors participants benefit from a more individualized and rigorous academic program in their major area of interest. At the minimum, nine credit hours in courses drawn from at least two of the following three categories are required: special courses for honors students, advanced (graduate) courses, and independent studies. To successfully complete the program, students must finish the designated coursework and achieve an overall grade point average of 3.25 or higher.

Students who complete an honors program are recognized by having an honors seal on their diplomas, a "H" beside their names in the commencement program, indication of completion of an honors program on their official transcripts, and their names in the Honors Convocation program.

The minimum admission requirement is a 3.0 (B) grade point average over all courses and a 3.25 grade point average in their major after at least nine credit hours of coursework. Many of the individual programs have higher admission requirements. Students who believe they are eligible and are interested in more information about honors program opportunities should contact the Associate Dean for Academic Affairs of their college or the Director of the University Honors Council.

Scholarships

UNIVERSITY MERIT AWARDS PROGRAM FOR ENTERING FRESHMEN

NCSU offers a competitive scholarship program for entering freshmen to recognize and to encourage exceptional academic ability and achievement. Graduating seniors of good character and leadership potential who have excelled in

their high school academic and extracurricular endeavors may apply for a large number of merit award opportunities at the University. Financial need is not a consideration in the selection of recipients for these awards.

Each year the Merit Awards Program conducts a nation wide competition for approximately 80 University wide scholarships (available to students entering any academic major) as well as over 125 other scholarships that are offered through individual colleges and departments. Completion of the Merit Awards Program application packet, which consists of the student's application as well as other supporting documents, assures that a student will be considered for all available freshman merit awards. The application packet is available by August preceding the student's senior year in high school, and the application deadline is November 1 of the senior year.

Semifinalists are identified from the entire applicant pool in mid-January and are invited to NCSU for personal interviews.

The **John T. Caldwell Alumni Scholarship**, which is sponsored by the NCSU Alumni Association, is the University's most prestigious award for entering freshmen. At least 30 Caldwell Scholarships valued at \$3500/year (up to \$14,000 for four years) for in state recipients and \$7000 year (up to \$28,000 for four years) for out-of-state recipients are offered each year. This excellent scholarship seeks students who demonstrate both academic excellence and strong leadership potential.

Yearly renewal of the Caldwell and the other University wide renewable awards assumes the maintenance of a 3.0 grade point average once a recipient is engaged in full time coursework at the University.

Many other scholarships ranging from \$1000 for the freshman year up to the Caldwells are available in each year's competition.

Students who meet two of the following criteria—3.75 high school grade point average (on a 4.0 scale), top 10% class rank, SAT total score of 1200 or above—should request their Merit Awards application packet from:

Merit Awards Program
North Carolina State University
2118 Pullen Hall, Box 7342
Raleigh, North Carolina 27695-7342

Telephone inquiries are welcome: (919) 515 3671

COLLEGE AND DEPARTMENTAL SCHOLARSHIPS FOR CONTINUING STUDENTS

A number of scholarships based upon academic achievement are administered directly through some of the academic departments for students engaged in full time coursework at the University. (See the "Colleges, Departments, and Programs of Study" section of this catalog). A continuing student should contact the college/department of his or her academic major for information about specific scholarship opportunities that do not require the filing of financial information.

Special Academic Programs

UNIVERSITY UNDESIGNATED PROGRAM

The University Undesignated Program, B-3 Nelson Hall, (919) 515-3592, helps selected freshmen explore the University's diverse programs of study for up to 36 credit hours before declaring their academic majors. The staff is responsible for academic advising and other activities designed to help enrolled students make rational and informed decisions in the selection of the major fields. Currently, approximately 200 new freshmen with a minimum expected first-year performance of about 2.4 are admitted each year. University Undesignated freshmen are required to enroll in a year-long orientation course specifically designed to provide a formal vehicle for the exploration of the many fields of study at the University as well as in a specially selected enrichment course.

UNIVERSITY TRANSITION PROGRAM

The University Transition Program, B 5E Nelson Hall, (919) 515 7053, serves to help selected new freshmen get a good start at NCSU. Approximately 65 freshmen are admitted to the University through this program. Participants in the program are required to attend the second Summer Session, taking carefully selected courses as a part of their freshman year. Additionally, as part of their first-year experience, University Transition students are enrolled in a one hour course focusing on personal development, study skills, and other areas crucial to college success. Individual advising on course selection, personal counseling, and tutorial assistance are provided throughout the year.

University Transition students may begin to select their major field of study during the second semester of their freshman year. Participants must transfer into a degree program no later than their fifth semester at NCSU.

COOPERATIVE EDUCATION PROGRAM

The Cooperative Education Program is designed to be an integral part of a student's educational program and is offered in all colleges. The co-op program enriches and expands classroom learning by providing sponsored, paid work assignments in industry, business and government. Work experience is selected based on its relevance to a student's major or career goals and provides for alternating semesters of study and full-time work. A parallel plan (part-time study and part-time work) is also available as an option in several colleges. Co-op participation does not constitute an interruption of college work.

The co-op experience normally takes place during the sophomore and junior years and means that attaining a degree will take more than eight semesters. A grade point average of 2.25 is required for students entering this program. Freshmen are not eligible, and transfers must first complete at least one semester at NCSU. Engineering students must have been admitted to a degree program. To remain in the program, students must maintain a cumulative average of 2.0, agree to participate for a minimum of 12 months of full time work experience or its equivalent, and be registered for co-op each work period.

EVENING UNDERGRADUATE DEGREE PROGRAMS

The College of Humanities and Social Sciences and the College of Management offer courses toward complete undergraduate degree programs during the evening hours for adult part-time students. In the College of Humanities and Social Sciences, sufficient courses are generally offered in the evening hours to complete majors in communication general option, communication public relations option, English, English-writing editing option, history, multidisciplinary studies, political science, sociology, criminal justice option in political science or sociology, and Spanish. In the College of Management, evening students pursue majors in accounting and business management. For more information, contact the Coordinator of Evening Programs, College of Humanities and Social Sciences, Box 8101, NCSU, Raleigh, NC 27695-8101, (919) 515-3638 or 515-2467; or the Office of Academic Affairs, College of Management, Box 8614, NCSU, Raleigh, NC 27695-8614, (919) 515 5565.

NON-DEGREE CERTIFICATE PROGRAMS

Non-degree certificate programs are prescribed sets of regular academic courses which offer limited but structured continuing education opportunities. They are designed expressly for Lifelong Education students. Students enrolled in undergraduate or graduate degree programs at NCSU are not eligible to participate simultaneously in these certificate programs. Satisfactory completion of the prescribed courses is recognized by the issuing of a certificate from the department or college that offers that program.

Certificate programs are currently offered by the following academic units: Department of Adult and Community College Education **Studies in Gerontology** (PBS students only) and **Trainer Development** (PBS students only); Department of Communication **Human Communication**, with track options in Communication Disorders, Mass Communication, and Theater; Department of Computer Science **Computer Programming** (PBS students only); Department of English **Professional Writing**; Department of Political Science and Public Administration **Management Development** (PBS students only) with program areas such as Adult and Community College Administration, Data Management, Financial Management, Human Resources Management, Management Control Systems, and Public Affairs; and the College of Textiles **Textiles** with subject areas including Apparel Production, Dyeing and Finishing, Fabric Production, Textile Fibers and Polymers, Fiber Science for Textile Conservators, Textile Administration, Textile Fundamentals, and Yarn Manufacturing.

For information concerning enrollment requirements and prescribed courses for a particular certificate program, consult the department or college offering that program or the Office of Adult Credit Programs & Summer Sessions, (919) 515 2265.

THE FIRST YEAR EXPERIENCE

The First Year Experience helps students make a successful transition to the college environment. Freshmen in the program live together in Metcalf Residence Hall and participate in a number of special freshmen-oriented programs. Such programs include two, one credit hour orientation courses which examine academic and social issues related to college success, "cluster classes" or NCSU courses restricted to First Year Experience students, some of which are held in Metcalf Residence Hall, and a mentoring program which introduces students to caring, resourceful upperclass students and faculty and staff.

Participation in the First Year Experience is selective and based on potential contributions to the program. Admitted students are expected to be actively involved. For additional information, contact the Assistant Dean for Undergraduate Studies, (919) 515 3037.

UNDERGRADUATE STUDIES TUTORIAL CENTER

The Undergraduate Studies Tutorial Center, 126 Nelson Hall, (919) 515-3163, is open to any student at NCSU taking 100 or 200 level courses in English, foreign languages, math, and science. It provides one-to-one and small group tutorials in many entry-level courses. Tutoring sessions focus on study skills and learning techniques as well as course content. Tutors are carefully selected for their ability to communicate and for their expertise in their subject areas. Students agree to meet with tutors on a regular basis once or twice a week and are encouraged to begin their participation in tutorials early in the semester and continue throughout the semester to assure their chances for academic success at NCSU. The program encourages communication between instructors and tutors.

Supplemental Instruction

The Undergraduate Studies Tutorial Center also offers Supplemental Instruction (SI) for selected sections of chemistry, mathematics, and physics. Students in SI sections of these courses can meet with an SI leader for three hours of review each week.

THE PEER MENTOR PROGRAM

The Peer Mentor Program is a student peer-helper program in which academically talented African-American upperclassmen serve as "mentors" to freshmen African-American students. The program stresses the mentoring process as a positive factor in the successful recruitment, advancement, and graduation of African American students at this University. The Peer Mentor Program assists the freshmen in making a successful transition to campus life by providing them with a supportive contact person who acts as a sounding board for personal adjustment concerns; interprets University policies and procedures; makes proper referrals to appropriate University services; and suggests to freshmen various strategies for academic, emotional, and social success at NCSU. Moreover, an integral component of the program is a focus on cultural awareness and identity as a means of helping mentors and freshmen to positively affirm their

skills and capabilities as an African-American on a large, predominantly white campus.

All incoming African-American freshmen are assigned a peer mentor prior to their arrival on campus in the fall. Whenever possible, the freshmen are paired with upperclassmen who are in the same major or college. Peer mentors are trained in "helping skills" and possess a working knowledge of the campus. Thus, they play a significant role in fostering in the freshman student a positive self-esteem and an appreciation of the potential benefits and rewards of college life.

COOPERATING RALEIGH COLLEGES

The Cooperating Raleigh Colleges (CRC) is a voluntary organization comprised of NCSU, Meredith College, Peace College, St. Augustine's College, St. Mary's College, and Shaw University for the purpose of developing and conducting cooperative educational activities. The organization 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.

Any NCSU *undergraduate degree* student who is enrolled in at least eight credit hours on the NCSU campus may take a course at another Raleigh college during a fall or spring semester (except that men may not enroll in courses at Peace College) provided that (a) the course is not taught on the NCSU campus and (b) the adviser and dean consider the course educationally desirable.

Students may not register for more than a total of two courses in any semester at other CRC colleges. Under extenuating circumstances, exceptions for an additional course registration may be approved by the requesting student's school dean.

Home campus students have first priority in class assignments. Courses taken at other institutions may be used as free electives and as alternatives to restricted electives, if so approved by the student's adviser and dean. Credits earned in this manner may apply toward fulfilling graduation requirements, but grades from other CRC institutions are not used in computing a student's NCSU grade point average. Under this agreement, regular tuition and fees are paid to NCSU. Certain special fees may be required for special courses at other colleges, and the student is responsible for paying such fees. During the summer, there is no interinstitutional program with local colleges. A student desiring to take a summer course must register directly with the institution offering the course.

Note: Lifelong Education students may not register for courses as interinstitutional students.

NATIONAL STUDENT EXCHANGE PROGRAM

NCSU is one of over 100 colleges and universities in the United States belonging to the National Student Exchange Program. Each year an opportunity is provided for NCSU students to study at one of the other participating schools and still pay the same tuition and fees they pay at NCSU, thus avoiding the red tape normally associated with a change of school. Students returning from exchange

reflect an increased feeling of independence, self-reliance and self-confidence, and a better appreciation of home region, family and home campus. A major impact of the exchange year has been an increased awareness and appreciation for the vast differences in ideas and values found in different geographic locations. Eligible students must be an undergraduate with a 2.5 grade point average or better and be selected by a screening committee. Preference is given to North Carolina residents. For further information contact the National Student Exchange Office in 2120 Pullen Hall, (919) 515-3499.

NORTH CAROLINA STATE FELLOWS PROGRAM

NCSU offers a self-development experience known as the North Carolina State Fellows Program. The program is designed to assist outstanding, talented students to develop their leadership potential at an accelerated pace, and to accomplish this in ways not usually afforded by the University. Each year approximately 30 new freshmen are selected to participate in the program as Fellows. The program seeks to identify students of exceptional ability and motivation and to encourage their development as potential leaders for business, governmental, educational and other professional communities. The program attempts to fulfill its goal by providing training and developmental opportunities.

International Programs and Activities

INTERNATIONAL STUDENTS

About 1,200 students from approximately 93 countries attend the University and enrich the campus and community. The International Student Office assists these students with immigration and passport matters, currency permits, and medical, personal, and social concerns.

International applicants are carefully screened for evidence of English language proficiency, adequate finances, and academic credentials indicating excellent potential for success. *The minimum TOEFL requirement for admission consideration to NCSU is 550 with scores of at least 50 on two sections and no score lower than 45.* The Lifelong Education Student category is not available to persons on temporary visas. The University has authority to issue Forms I-20 for F-1 visas and Forms IAP-66 for J-1 visas to fully qualified individuals.

An orientation program for new international students is conducted during the week preceding the fall and spring semesters.

International students are required to purchase one of the two University student insurance policies or provide proof of agency sponsor coverage. Special courses in English for Foreign Students (FLE) are required for those whose scores on the Test of English as a Foreign Language (TOEFL) are sufficiently high for admission but who need further instruction to perform well academically.

The International Student Committee of the University Student Center sponsors a variety of social and cultural programs for international and American students.

SUMMER INSTITUTE IN ENGLISH FOR SPEAKERS OF OTHER LANGUAGES

The Summer Institute in English for Speakers of Other Languages is a five week, intensive English language program for students from other countries who intend to pursue university studies or specialized training programs in the United States in the fall. The institute, which is jointly sponsored by the Department of Foreign Languages and Literatures and the Division of Continuing Studies, is held from early July to early August each summer. It is designed to provide students with intensive instruction and practice in the use of the English language. Emphasis is on developing fluency in speaking and understanding oral English as well as reading and writing skills.

The institute also offers orientation to American life and institutions to give students insight into life in the United States and to help them to adjust to the new environment. There are films, lectures by guest speakers, and field trips on weekends to places of historic, cultural, and scenic interest.

Prospective students should have studied English and acquired some facility in the use of the spoken language prior to enrolling in the institute since its curriculum is not designed for beginners.

Admission to the institute does not imply admission as a degree candidate at NCSU or any other campus of the University of North Carolina System.

The TOEFL (Test of English as a Foreign Language) is administered to students who wish to take it on the last day of the program. Since this is an institutional administration of the test, scores may not be sent to other institutions but are accepted by the Admissions Office and Graduate School at NCSU.

ALEXANDER INTERNATIONAL PROGRAM

The Alexander International program is a residence hall community for both American and international students. The 174 resident members of the program share the common goal of developing their understanding of different cultures and countries and developing cross-cultural relationships. The 87 American students and the equal number of international students, representing approximately 40 foreign countries, become more sensitive to the values of different peoples, systems of government, economic structures, and religions. These goals are achieved through informal interactions, social and educational program ming, and American and international roommate pairing.

Program activities in past years have included both an international dinner and international coffeehouse series, emphasizing customs, foods, and entertainment from various cultures. Workshops on cultural differences, cross-cultural communication and relationships, international employment opportunities, and overseas studies are regularly included in the annual calendar of programs and activities. These activities provide an opportunity for American students to add an international dimension to their education while attending NCSU.

Participation in this international program is selective and based upon potential contributions to the program. Students are expected to be active participants, to initiate programming, and to be supportive of the program goals. Students interested in applying or wishing additional information should inquire at 105 Alexander International Hall. (919) 515 2925.

STUDY, TRAVEL, AND SHORT-TERM EMPLOYMENT ABROAD

The Study Abroad Office assists students interested in overseas study and travel, short-term employment in foreign countries, and national and international scholarship competitions for study abroad. The staff provides personal and group advising, sponsors program presentations and information sessions, conducts orientation programs, and maintains a resource library.

Many students participate in study abroad programs sponsored by NCSU, other United States colleges and universities, United States educational institutions, and foreign universities. The Study Abroad Office maintains descriptive literature and directories for over 1,000 individual programs. The staff advisors will assist students in selecting and evaluating various programs, assist in the procedure for approval of academic credit transfer, and suggest basic orientation readings and activities. The resource library materials include information on grant sources and competitions. These include annual competitions such as Fulbright Grants for graduate study, Marshall Scholarships for graduate study in the United Kingdom, Rhodes Scholarships for Oxford University, England, and many programs which award specific country or specific academic curriculum grants for foreign study.

Short-term employment and internship positions in a foreign country are also available. A program sponsored by the Council on International Educational Exchange assists students interested in summer or short-term (3-6 months) employment in Great Britain, France, Ireland, Germany, New Zealand, Canada, Jamaica, and Costa Rica. InterExchange coordinates similar programs in Australia, Austria, Finland, France, Norway, Switzerland, West Germany and Yugoslavia. Both of these programs provide for employment visas and assistance in obtaining short-term employment.

For students interested in summer and vacation period travel, the Study Abroad Office can provide assistance in planning a trip. Information is available concerning passport and visa applications, low cost accommodations, group travel programs, Eurail and other public transportation discount programs, International Student Identity Cards, overseas travel arrangements, and background information on specific countries.

Students interested in discussing study, travel, and short term employment in other countries should contact the Study Abroad Office, 2118 Pullen Hall, (919) 515-2087.

International Student Exchange Program. NCSU is one of 100 colleges and universities in the United States participating in the International Student Exchange Program. Through ISEP, undergraduate students may attend any of 100 member institutions in Africa, Asia, Australia, Canada, Europe, and Latin America on an exchange student basis for a summer semester or single academic year.

NCSU students pay a program fee for their stay abroad which is based on their regular tuition and fees plus the cost of room and board at NCSU. Aside from travel expenses and health coverage, ISEP makes it possible for NCSU students to study outside the country for the same cost of continuing studies at NCSU. This arrangement also allows students to maintain their eligibility for financial aid. While abroad, ISEP students are entitled to all the benefits and services of regular full time students at their host institutions. Room and board are provided and an ISEP coordinator on each campus is available to students for assistance with any problem.

To apply to participate in ISEP at NCSU a student should have a cumulative grade point average of at least 2.75 and have already studied at NCSU for two semesters. Applicants must be proficient in the language of instruction at the study sites they choose. A campus selection committee, made up of faculty members, chooses those applicants as NCSU's participants. Applicants are not in competition with each other. The ISEP Selection Committee bases its decision on the feasibility of each applicant's proposed course of study, on academic background, application and references. The selection process for each academic year takes place in the winter of the preceding year. Students begin the application process by requesting a copy of the ISEP Directory from the Study Abroad Office.

Semester in Santander, Spain. The University of North Carolina at Charlotte and NCSU, in cooperation with the University of Cantabria, offer a Fall Semester Abroad program in Spain. Undergraduates from both North Carolina institutions, as well as qualified students from other institutions, spend a semester in the coastal city of Santander, taking classes in Spanish language, literature, art, geography and history. Students entering the program are expected to have completed four semesters of college Spanish or the equivalent with a grade of C or better. Overall academic average should be at least 2.5. Students may enroll for 12 to 15 credit hours. A member of the NCSU faculty of Foreign Languages and Literatures serves as resident director of the program.

Summer Study at Oxford, England. This program offers NCSU students a four-week summer experience at Oxford, England. The program is limited to 30 participants and students may take one or two courses. Academic transfer credit is granted for this work by NCSU. Courses usually include Shakespeare, British History, and History of Art. All courses are taught by British scholars. Ample time is made available for independent travel in order to maximize the British experience.

Summer Study in London, England. The College of Humanities and Social Sciences and the Division of Student Affairs offer a four-week summer study program in London. Students live at Canterbury Hall, University of London, and take one or two credit courses in British literature or the arts offered by NCSU faculty. The courses are illustrated by group visits to various literary and historical sites in the London area as well as all-day tours outside of London. Evening sessions include plays, concerts, and lectures by British authorities. Weekends are free for independent travel.

Summer Study in Mexico. The Department of Foreign Languages and Literatures sponsors a five-week Summer Study Program in Mexico, through which

students can gain up to six academic credits. The program for both beginning and advanced students is designed to foster oral command of the language and to provide enrichment through first-hand knowledge of Mexican civilization and culture. In Mexico students visit places of interest, attend daily classes and have the opportunity to live with a Mexican family. A member of the NCSU faculty of Foreign Languages and Literatures serves as resident director and advisor, coordinating both academic work and extracurricular activities.

Summer Study in Vienna. This program offers a four-week course of study in the German language and in the arts of Vienna in 1900. Students live in the baroque palace at Neuwaldegg, located at the edge of the Vienna Woods. The program includes an excursion to the castles and monasteries on the Danube and a trip to the Alps in Semmering. Most afternoons, evenings, and weekends are free to explore one of the world's most beautiful and vibrant cities.

Summer Design Programs Abroad. NCSU is continually expanding the selection of summer study abroad design programs. Courses in architecture, landscape architecture, and the applied arts are currently available in Berlin, Germany, Prague, Czechoslovakia, and Santander, Spain. Check with the Study Abroad Office for an update of these programs.

In addition to the study abroad programs described above, NCSU sponsors semester and year-long exchanges in England, France, Japan, Netherlands, Costa Rica, Australia and Scotland. Details on these programs are available from the Study Abroad Office.

Admissions

The freshman application deadline for the fall semester and summer sessions is February 1; the transfer student deadline is April 1. Freshmen are encouraged to apply during the fall of the senior year in high school, as students will be accepted until the classes have been filled. All applicants for the School of Design must submit applications by January 1. Applications for the spring semester should be submitted prior to November 1. The School of Design does not admit students in the spring.

Each applicant must complete an application form which may be obtained from high school counselors or by writing to:

Director of Admissions
Box 7103
North Carolina State University
Raleigh, North Carolina 27695-7103

A nonrefundable \$35 fee must accompany the completed application.

FRESHMAN ADMISSION

Admission to the University is competitive, and it is possible to be admissible to some programs but not to all programs at NCSU. Applicants are asked to indicate their first, second and third choices for a curriculum, including undeclared majors within a college, or to indicate their choice of participating in the

University Undesignated Program. Applications which are not admissible in the first curriculum choice will be reviewed for admissibility in the alternate curriculum choices. Transfer between programs after a successful first year may be possible.

The admissions decision is based on the evaluation of the high school record, including the level and difficulty of the courses taken, the overall grade point average, rank in class, and scores on the Scholastic Aptitude Test (SAT) or the American College Testing Program (ACT). These factors are reviewed with the curriculum choice to determine admissibility as a freshman at NCSU. Any exceptions to University admissions requirements must be approved by the faculty members of the University Undergraduate Admissions Committee.

In addition, the Board of Governors of the University of North Carolina System has determined that the minimum undergraduate admissions requirements for all constituent institutions, including NCSU, shall be:

A high school diploma or its equivalent

English four course units in English, emphasizing grammar, composition, and literature

— Mathematics three course units in math, including algebra I, algebra II, and geometry, or a higher level math course for which Algebra II is a prerequisite

Social Studies two course units in social studies, including one unit in United States history

Science three course units in science, including at least one unit in a life or biological science; at least one unit in a physical science (for example, physical science, chemistry, or physics) and at least one laboratory course.

Further, it is recommended that prospective students complete at least two course units in one foreign language. *Beginning in the fall of 1994, two years of the same foreign language will be required of all incoming freshmen.* It is recommended that every student take one foreign language course and one mathematics course in the twelfth grade. *Any additional entrance requirements for admission to NCSU will be set forth in the Freshman Admissions Bulletin for that year.*

Applicants are accepted on either junior or senior test scores, although senior scores are recommended, especially if the applicant is also applying for financial aid or scholarships. An interview is not required and does not weigh in the admissions decision; a prospective student is always welcome to visit the Admissions Office, 112 Peele Hall. The Admissions Office conducts group information sessions every Monday, Wednesday, and Friday at 10:30 a.m. and on Tuesday and Thursday at 1:30 p.m. Campus tours led by students are conducted each weekday, weather permitting, at 12:15 p.m., starting at the Memorial Bell Tower.

Two-Year Agricultural Institute

Requirements for admission to the Agricultural Institute, a two-year program, include graduation from an accredited high school or successful completion of the high school equivalency examination administered by the Department of Community Colleges. The application should include either a copy of the high school record or a letter indicating the applicant has passed the equivalency examination and a letter of recommendation. Each application is reviewed and evaluated

by the Agricultural Institute Director. SAT scores are not required but are recommended. Course work is not transferable into the four-year degree programs.

Scholastic Aptitude Test

Applicants for admission as freshmen must take the College Board Scholastic Aptitude Test (SAT) and request that their scores be sent directly from the Board to NCSU (Code No. R5496). Information booklets and application forms may be obtained from school counselors or by writing:

The College Board ATP
Box 592
Princeton, New Jersey 08541

Applicants may also submit scores from the American College Testing Program (ACT) (Code No. 3164).

ACT Records Department
P.O. Box 451
Iowa City, Iowa 52243-0451

Achievement Tests

Freshman students must present Mathematics Achievement Test scores to ensure proper math placement at NCSU. Students in curricula for which the normal first mathematics course is calculus should take the Level II test. Students in all other curricula should take the Level I test. Current admissions information and the application contain information about appropriate achievement tests for each curriculum.

The English Achievement Test is recommended for more accurate placement in beginning English classes.

Advanced Placement

A student may qualify for advanced placement by one or more of the following means: (1) by passing a proficiency examination administered by a teaching department at NCSU; (2) by attaining a sufficient predicted grade in English (PGE) which is based on the SAT Verbal score or English Achievement Test and the high school record, including grade point average and class rank; (3) by attaining a score of 600 or higher on the verbal portion of the SAT; (4) by meeting a specific minimum score on certain of the CEEB Advanced Placement Program (APP) examinations; and (5) by attaining at least a minimum score (generally 3) on certain of the College Level Examination Program (CLEP) subject tests.

OUT-OF-STATE STUDENTS

Undergraduate applicants from outside North Carolina may be required to meet more competitive standards for admission than North Carolina residents. NCSU is limited to accepting not more than 18 percent of total new undergraduate students from outside the State.

TRANSFER STUDENTS

NCSU welcomes transfer applicants, and in recent years, more than 25 percent of our graduates started their college programs at other institutions. A transfer student should present at least 28 semester hours (or 42 quarter hours) of satisfactory (C or better) college level work with a minimum overall 2.0 (C) average on all college work attempted and be eligible to return to the last institution regularly attended. *Most programs require a higher minimum grade point average for admission.* Individual official transcripts must be submitted from each institution attended. The college credits must have been earned at a regionally accredited institution and must include a college-level math and a college-level English course. Applications of students from non regionally accredited institutions will be reviewed by the Admissions Committee.

Students who graduated from high school in June of 1988 or later must submit a high school record to verify that they have met minimum admissions requirements as outlined in the Freshman Admissions section of this catalog. Exceptions to this requirement are students who will have earned an A.A., A.S. or A.F.A. degree before enrolling at NCSU. Individuals who do not have the minimum admissions requirements at the high school level must complete at the college level six semester hours or nine quarter hours each of English, mathematics, science and social science to be eligible to transfer.

Applications from technical institutes, technical colleges, and technical programs at community colleges are evaluated on an individual basis. Credits from such programs are generally not considered for automatic transfer, but qualified students who are otherwise admissible may receive transfer credit by prescribed procedures. These procedures include credit by examination and/or validation by the appropriate subject matter academic unit on the NCSU campus.

Once applicants have been accepted and have indicated their intention to enroll, their transcripts are evaluated by the college to which application is made to determine the exact amount of credit applicable toward a degree at NCSU. A grade of C or better is required before a course may be considered for credit. Transcripts are not evaluated until the applicant has been admitted. International students are carefully screened for evidence of English language proficiency, adequate financial backing and academic credentials indicating potential for success.

UNCLASSIFIED STUDENTS

Unclassified students are those working for college credit but not enrolled in a degree granting program. Admission as an unclassified student requires the recommendation of the dean of the school in which the student wishes to enroll. Unclassified students must meet the same entrance requirements as regular degree students and must meet the same academic requirement to continue. If, at a later date, unclassified students wish to change to regular status, their credits will be evaluated in terms of the requirements of their intended curriculum.

LIFELONG EDUCATION STUDENTS

The Lifelong Education student classification is designed for residents of the Triangle area who have not been formally admitted into a degree program at the University but who wish to enroll in courses offered by the University. Lifelong Education students are limited to a maximum course load of two courses plus one physical education course each semester or summer session.

Lifelong Education student applications should be made through the Office of Adult Credit Programs & Summer Sessions, at the McKimmon Center, corner of Western Boulevard and Gorman Street. If Lifelong Education students wish to become degree candidates at a later date, they must make application through the Admissions Office. Lifelong Education students who are considering a degree program are encouraged to make an appointment with the Admissions Office to discuss entrance requirements.

SERVICEMEN'S OPPORTUNITY COLLEGES

NCSU has been designated as a member of the Servicemen's Opportunity Colleges (SOC) General Registry—a network of institutions sponsored by the American Association of State Colleges and Universities and the American Association of Community and Junior Colleges. Servicemen are encouraged to take college level courses offered by accredited institutions and made available to military personnel through SOC. Records are evaluated, files are retained, counseling is provided, and recognition is given for learning through noninstitutional sources when appropriate. Transcripts must be sent to the Director of Admissions directly from the institution offering the course.

COLLEGE LEVEL EXAMINATION PROGRAM (CLEP)

A national program administered by the College Board, CLEP is a series of examinations that allows students to show knowledge in a wide range of areas. The tests are used to grant credit for corresponding college courses. There are five General and 30 Subject Examinations. At NCSU credit is granted primarily for Subject Examinations, as these provide a more satisfactory evaluation of subject matter covered in NCSU courses. Scores and essays, if required, are reviewed and credit granted by the department offering the corresponding course.

Information regarding credit and testing dates and locations can be obtained in the Counseling Center, 2000 Harris Hall, (919) 515-2423.

Both General and Subject Examinations at NCSU are administered during the third calendar line of each month except December and February. It is necessary to register for the examinations at least three weeks before the first of the week in which they are to be given. The examinations are administered through the Counseling Center at North Carolina Central University, Durham, North Carolina, (919) 683 6336.

GRADUATE STUDENTS

Procedures and policies governing graduate admission are outlined in a separate catalog issued by the Graduate School. For a copy of the *Graduate Catalog* write:

Dean of the Graduate School
104 Peele Hall
Box 7102
North Carolina State University
Raleigh, North Carolina 27695 7102

Orientation

The University provides a series of orientation programs for all new freshmen. Students attend their program with other freshmen who have been admitted to the same college, the University Undesignated Program, or the University Transition Program. Meetings and conferences with faculty and student leaders acquaint new students with the academic opportunities and expectations associated with their chosen curriculum and with the extracurricular activities and organizations available on campus. For more information, contact the Division of Undergraduate Studies, B 26 Nelson Hall, (919) 515 3037, or the Department of Student Development, 2007 Harris Hall, (919) 515-2443.

REQUIRED IMMUNIZATION DOCUMENTATION

North Carolina state law requires all new enrollees in the university system to present proof of immunization prior to completion of registration.

Verified proof of immunization against rubella, measles, tetanus and diphtheria must be presented to the University Student Health Service no later than 30 days prior to registration.

If this requirement is not met, dismissal from school is mandatory under the law. For assistance, contact the Student Health Service, (919) 515-2563.

Registration

Registration is conducted by using the Telephonic Registration Access to Computerized Scheduling (TRACS) system. This system allows students to use any touch-tone telephone to register for classes. A Schedule of Courses is available for every semester prior to the beginning of the registration period. This contains all necessary instructions for completing registration.

Registration consists of three steps: (1) meeting with advisers to determine course requirements and to obtain a Personal Identification Number (PIN); (2) registering for courses using the TRACS system; and (3) paying tuition and fees and all other debts to the University by the established deadlines. Instructions for completing registration are issued each semester and summer session.

For more information, contact the Department of Registration and Records, 1000 Harris Hall, (919) 515-2572.

INTERINSTITUTIONAL REGISTRATION

A regularly enrolled undergraduate degree student who is enrolled in at least eight credit hours at NCSU may take, under certain conditions, course work at one of the Raleigh colleges, at the University of North Carolina at Chapel Hill, at the University of North Carolina at Greensboro, or at Duke University. Interinstitutional registration forms and all registration procedures are available from the Department of Registration and Records.

SCHEDULE CHANGES—DROPS AND ADDS

Courses may be added during the first two weeks of a regular semester. All courses may be dropped without regard to course load during the first two weeks of a regular semester. During the third and fourth weeks of a semester, full-time undergraduate students who wish to drop courses at any level and whose academic load would thereby fall below the twelve-hour minimum course load may do so only for documented medical reasons or other verified, unforeseen grounds of personal or family hardship.

For undergraduate students, exceptions to the drop policies require the recommendation of a student's adviser (or the departmental coordinator of advising or the department head) and approval by the student's dean. Students who wish to drop all courses for which they are enrolled, must withdraw from the University for the remainder of the semester or summer term in which they are enrolled. A degree student who finds it necessary to drop all courses will initiate withdrawal from the University at the Counseling Center, 2000 Harris Hall.

Tuition and Fees

North Carolina Resident—\$659.00 per semester

Nonresident—\$3,951.00 per semester

A statement of tuition and fees is mailed to each preregistered student before the beginning of any term. The statement must be returned with full payment or complete financial assistance information by the due date appearing on the statement. Normally the due date is two weeks before classes begin. Non-preregistered students are required to pay their tuition and fees at registration. Fees are the same for both residents and nonresidents and are required of all students. Nonresident students are required to pay an additional \$3,292 per semester for tuition.

ESTIMATED ANNUAL UNDERGRADUATE EXPENSES

<i>Tuition and Fees</i>	<i>First Semester</i>	<i>Second Semester</i>	<i>Year</i>
(a) N.C. Residents	\$ 659.00	\$ 659.00	\$ 1,318.00
(b) Out of State Residents	3,951.00	3,951.00	7,902.00
Room Rent	725.00	725.00	1,450.00
Meals	950.00	950.00	1,900.00
Books and Supplies	250.00	250.00	500.00
Other personal expenses	500.00	500.00	1,000.00
<i>Total</i>			
(a) N.C. Residents	\$3,084.00	\$3,084.00	\$ 6,168.00
(b) Out-of State Residents	\$6,376.00	\$6,376.00	\$12,752.00

NOTE: All charges are subject to change without notice.

EXPENSES OTHER THAN TUITION AND GENERAL FEES

Application Fee: A non-refundable fee of \$35 must accompany each application for admission.

Room Rent: New incoming students receive room reservation instructions in the letter of acceptance. Continuing students are provided a card with instructions at their residence hall rooms. The 1992-93 charge for room rent ranged from \$725 per semester for most residence halls to \$990 for North Hall, Wood Hall, and Watauga Hall.

Meals: During their first academic year, new freshmen electing to reside on campus are required to participate in one of the University's available meal plans. Meal plan costs in 1992-93 ranged from \$800 to \$950. Other students pay for meals individually at the various dining facilities available both on and near the campus.

Books and Supplies: Books and supplies are usually purchased during the first week of classes directly from the Students Supply Stores. Allow approximately \$250 per semester for purchasing books and supplies.

Personal Expenses: Personal expenses vary widely among students but the estimate of \$500 is based on what students report that they spend on these items.

Administrative Management Fee: A special administrative management fee of \$250 per semester and \$150 per summer session is required from a contracting agency sponsoring international students whose programs are coordinated through the University's Office of International Visitors.

Cooperative Education Program Fee: Required of all participating co-op students for each semester in which they are enrolled in an off campus work assignment. This fee, set at \$188 for the 1992 fall semester, the 1993 spring semester, or the combined 1993 summer sessions, is used for partial support of the Cooperative Education Program staff in job development and placement activities. Students paying this fee are entitled to all University services, facilities, and programs during the semester or combined summer sessions for which they are enrolled.

College of Engineering Computing Fee: All students enrolled in the College of Engineering, both graduate and undergraduate, will be billed a \$100 per

semester fee to support the Engineering Computing Facility. Payment of the fee will provide students with access to standalone workstations which comprise the Engineering Computing Facility.

Students who enroll in a co-op work session will not be billed for the Computing Fee unless they also enroll in NCSU courses.

Fees Related to Laboratory and Computer Courses: Students enrolled in designated lab or computer courses must pay a course fee of \$25 to offset partially the cost of necessary supplies, equipment, and operation. The maximum course fee to be charged to any student will be \$50 per semester or summer session regardless of the number of designated courses taken. These fees will be assessed for courses carried *at the end of the official enrollment period*, i.e., the end of the second week of a semester or the end of the fourth class day during a summer session.

Departments may waive a course fee when: students are auditing a designated course in which the conditions of the audit preclude any usage of lab or computing resources; or students in special projects, independent research, and similar courses which have a designated fee, are not using a University lab course but who mistakenly are registered for the lab section; or students are taking only the lecture portion of a designated lab course but are mistakenly registered for the lab section.

Departments may *not* waive a course fee when: a designated lab or computer fee course is dropped *after the official enrollment date*, or withdrawal from the University occurs *after the official enrollment date*, or state law or policy allows for a waiver of tuition (i.e., faculty staff, over 65 years of age, exchange programs, etc.).

Students who withdraw from the University *after the official enrollment date* may petition the Fee Appeals Committee, and refunds of course fees will be handled on a prorated basis as are refunds of other fees.

Note: All charges are subject to change without notice.

REQUIRED FEES

Required fees are levied for services, facilities, and programs available to all students whether or not the student takes advantage of them. Students are assessed fees based on the course load they are taking. An itemization of required fees and other detailed information concerning expenses or related data can be obtained by contacting the University Cashier's Office, NCSU, Box 7213, Raleigh, North Carolina 27695 7213, (919) 515-2986.

REFUND POLICY

A student who officially withdraws from school during the first two weeks of classes will receive a tuition and fees refund of the full amount paid less a \$25 registration fee. After the two-week period, no refunds will be made. In some instances, circumstances justify the waiving of rules regarding refunds. An example might be withdrawal because of sickness. Students have the privilege of appeal to the Fee Appeals Committee when they believe special consideration is merited. However, no refunds are granted after the first six weeks of a semester,

regardless of the reason causing the withdrawal, since full institutional costs will have been incurred. Applications for such appeals may be obtained from the University Cashier's Office, 1101 Pullen Hall.

RESIDENCE STATUS FOR TUITION PURPOSES

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

Residence. To qualify as a resident for tuition purposes, a person must become a legal resident and remain a legal resident for at least 12 months immediately prior to classification. Thus, there is a distinction between legal residence and residence for tuition purposes. Furthermore, 12 months legal residence means more than simple abode in North Carolina. In particular, it means maintaining a domicile (permanent home of indefinite duration) as opposed to "maintaining a mere temporary residence or abode incident to enrollment in an institution of higher education." The burden of establishing facts which justify classification of a student as a resident entitled to in-state tuition rates is on the applicant for such classification, who must show his or her entitlement by the preponderance (the greater part) of the residency information.

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

Parents' Domicile. If an individual, irrespective of age, has living parent(s) or court appointed guardian of the person, the domicile of such parent(s) or guardian is, prima facie, the domicile of the individual; but this prima facie evidence of the individual's domicile may or may not be sustained by other information. Further, nondomiciliary status of parents is not deemed prima facie evidence of the applicant child's status if the applicant has lived (though not necessarily legally resided) in North Carolina for the five years preceding enrollment or re registration.

Effect of Marriage. Marriage alone does not prevent a person from becoming or continuing to be a resident for tuition purposes, nor does marriage in any circumstance insure that a person will become or continue to be a resident for tuition purposes. Marriage and the legal residence of one's spouse are, however, relevant information in determining residency intent. Furthermore, if both a husband and his wife are legal residents of North Carolina and if one of them has been a legal resident longer than the other, then the longer duration may be claimed by either spouse in meeting the 12-month requirement of in-state tuition status.

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

In addition, a separate North Carolina statute affords tuition rate benefits to certain military personnel and their dependents even though not qualifying for

the in-state tuition rate by reason of 12 months legal residence in North Carolina. Members of the armed services, while stationed in and concurrently living in North Carolina, may be charged a tuition rate lower than the out-of-state tuition rate to the extent that the total of entitlements for application tuition costs available from the federal government, plus certain amounts based under a statutory formula upon the in-state tuition rate, is a sum less than the out-of-state tuition rate for the pertinent enrollment. A dependent relative of a service member stationed in North Carolina is eligible to be charged the in-state tuition rate while the dependent relative is living in North Carolina with the service member and if the dependent relative has met any requirement of the Selective Service System applicable to the dependent relative. These tuition benefits may be enjoyed only if the applicable requirements for admission have been met; these benefits alone do not provide the basis for receiving those derivative benefits under the provisions of the residence classification statute reviewed elsewhere in this summary.

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

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

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

(2) If a minor has lived for five or more consecutive years with relatives (other than parents) who are domiciled in North Carolina and if the relatives have functioned during this time as if they were personal guardians, the minor will be deemed a resident for tuition purposes for an enrolled term commencing immediately after at least five years in which these circumstances have existed. If under this consideration a minor is deemed to be a resident for tuition purposes immediately prior to his or her eighteenth birthday, that person on achieving majority will be deemed a legal resident of North Carolina of at least 12 months

duration. This provision acts to confer in-state tuition status even in the face of other provisions of law to the contrary; however, a person deemed a resident of 12 months duration pursuant to this provision continues to be a legal resident of the state only so long as he or she does not abandon North Carolina domicile.

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

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

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

Note: General Statute (G.S.) 116-143.1 is the prevailing statute governing residence status classification. Copies of the applicable law and of the implementing regulations are available for inspection in the Office of Undergraduate Admissions, 112 Peete Hall.

Financial Aid

To be considered for assistance by the Financial Aid Office, a student and his or her parents must complete an application approved by the federal government and submit this application to the designated processing center for evaluation of the family's ability to pay for educational expenses. This form, referred to as a "need analysis" form, is available from both high school guidance counselors and from the NCSU Financial Aid Office. The need analysis form generally preferred by NCSU is the Financial Aid Form (FAF), which should be completed preferably by March 1 of the year prior to fall semester enrollment. By completing this form, all undergraduates will be given consideration for the federal Pell Grant and other forms of federal financial assistance, as well as most types of state and institutional financial aid (except for departmental and merit awards). Transfer and continuing students should check with the Financial Aid Office regarding any other information which may be needed for aid consideration.

Awards are made to applicants on the basis of financial need, satisfactory academic progress, and timely submission of the FAF to Princeton, New Jersey.

Determination of a student's need is based on estimated educational costs and a consideration of the family's financial strength, which primarily includes consideration of the family's income, including the student's income, size of family, number of children in post-secondary institutions, family assets (except for home, farm and business) and other resources that may be available for use such as veterans' benefits, Vocational Rehabilitation assistance, etc.

Aid is available on a non-discriminatory basis to all qualifying students. These awards are usually offered in financial aid "packages" which consist of a combination of scholarship gift aid (grants), loan, and/or work study award, depending upon the degree of need. Continuing students must have a satisfactory record of academic progress in order to renew their aid. The Policy on Satisfactory Academic Progress for Financial Aid Eligibility is available in the Financial Aid Office. A new need analysis form must be submitted each year for continued consideration for assistance.

NEED-BASED SCHOLARSHIPS FOR FRESHMEN AND CONTINUING STUDENTS

There are a large number of special scholarships which are based upon both demonstrated financial need and academic achievement. These scholarships are administered by the University's Financial Aid Office as well as by various academic departments on campus. Some of these scholarships have curricular, geographic and other restrictions. A list of these scholarships and the specific criteria which may apply to them may be found in the handbook published by the NCSU Financial Aid Office. Filing the Financial Aid Form by early March will assure the student is considered for all need based scholarships for which he/she is eligible.

GRANTS

Pell Grants All applicants for financial aid who have never received a bachelor's degree are considered for this program. Eligibility for a Pell Grant is determined by the federal government, based on the information provided on the FAF.

Supplemental Educational Opportunity Grants These grants are made from federal funds to undergraduate students from low income families. They are especially useful in assisting very needy students who apply for assistance. These grants are determined by the University's Financial Aid Office.

Minority Presence Grants—Under the Board of Governors' general Minority Presence Grant Program, African-American students may be eligible for special financial assistance if they are residents of North Carolina, enrolled for at least six hours of degree credit coursework and demonstrate financial need.

The N.C. Student Incentive Grant—This program provides grants to legal residents of North Carolina with substantial need. Grants range up to \$1,500 per academic year. Since funds are extremely limited, generally only early applicants are awarded these grants. These funds are awarded by the College Foundation.

ATHLETIC GRANTS-IN-AID

Athletic awards are made by the Department of Athletics to students who meet the established qualifications for such awards. These awards are based upon athletic ability rather than upon need.

LOANS

Perkins Loans (formerly National Direct Student Loans)—Both undergraduate and graduate students carrying at least half-time academic loads may be awarded these long term, low-interest loans. These loans are need based. Six months after ceasing to be enrolled at least half time, a student must begin paying interest on his or her loan at 5% per year as well as assuming a \$30 per month minimum repayment obligation. In order to establish a repayment schedule, borrowers are expected to have exit interviews at the Student Accounts Office just prior to graduation or other termination of studies.

Institutional Loans A limited amount of other long term loan money is available in several funds, and these loans are on essentially the same liberal terms as the Perkins Loans.

Insured Student Loan Programs.

Robert T. Stafford Loan Program (formerly Guaranteed Student Loan): These low interest, deferred payment funds are federal need-based assistance. The interest rate is variable but will not exceed 9%. Application for this program begins with the FAF. Further application is necessary through the individual lender and requires college certification of eligibility. The North Carolina lending agency is College Foundation, Inc., (919) 821 4771.

Supplemental Loan for Students (SLS)

Unsubsidized Stafford Loans

Parent Loan for Undergraduate Students (PLUS)

These loan programs are designed for independent students (SLS) and for parents of dependent students (PLUS). These programs are not need-based. Payment options, along with interest rates, will vary but not exceed 11% for SLS and 10% for PLUS. Application requires college certification and is then submitted to the individual lender. The North Carolina lending agency is College Foundation, Inc., (919) 821-4771.

Emergency Short-Term Loans—These loans are available in small amounts (usually not exceeding \$100) to enable any full-time enrolled student with a previous good repayment record to meet unexpected expenses. These loans are usually to be repaid within 30 days and are not extended beyond the end of a term or graduation.

COLLEGE WORK-STUDY PROGRAM

The federally supported College Work-Study Program provides jobs on campus for students who qualify with need in the same manner as is required for scholarship or long term loan assistance. Though individual pay rates vary with the job, basic hourly pay rates comply with the current minimum wage requirements.

STUDENT EMPLOYMENT SERVICE

The Financial Aid Office coordinates an employment service to assist students with information about the possibilities of part-time or summer work. No particular academic or economic qualifications are required to obtain jobs on or off campus outside the College Work-Study Program. A current listing of job openings is maintained at the Financial Aid Office.

A handbook which gives a detailed explanation of the need-based aid application and award process and the types of aid available may be obtained upon request from the Financial Aid Office, 2005 Harris Hall.

Student Housing

NCSU furnishes housing for approximately 7,106 students. The University operates residence halls which house 3,832 male and 2,409 female students. In addition, 295 apartments are available for married students, single parents and graduate students in E. S. King Village, and 15 University-owned fraternity and sorority houses accommodate 570 student members.

RESIDENCE HALLS

The residence halls are operated to provide opportunities, through a variety of group living experiences, which complement and expand the students' educational experiences. Each hall is staffed with selected graduate and undergraduate students who report directly to professionally trained members of the Department of Housing and Residence Life. Staff members are available to help students initiate programs and activities and to advise and assist residents as needed.

The residence halls are grouped into three areas—East, Central and West Campus—with each of the areas providing laundry facilities, convenience stores and recreational grass areas for sports. Living arrangements in the halls vary and include buildings with suites of four or five rooms that share a bath and buildings with rooms opening onto a center corridor. Opportunities for either single gender or coeducational living arrangements are available. Rooms are furnished with a desk, chair, dresser, bed and mattress, small closet, and waste basket for each student, but students must provide bed linen, pillows, and towels.

Eligibility. To be eligible for University housing one must enroll as a regular full-time student (an undergraduate must carry a minimum of 12 credit hours per semester).

NCSU guarantees on-campus housing for the first year to all new freshmen. During the second semester of the freshman year, all resident freshmen participate in a Random Selection Process which determines housing eligibility for subsequent years. Students selected during this process are guaranteed housing for their remaining three years. Other upperclass students, including graduate, transfer, and readmitted students are not guaranteed campus housing, but are housed on a space available basis.

Room Costs and Reservations. The room cost for 1992 1993 was \$725 per semester for main-campus double rooms; this rate is subject to change on an annual basis.

Cancellation of Housing. Cancellation of housing applications must be made *in writing* as follows:

- a. in person at the Housing Assignments Office, Department of Housing and Residence Life, 1112 Pullen Hall, Monday through Friday between 8:00 a.m. and 5:00 p.m.; or
- b. by mail addressed to the Housing Assignments Office, Department of Housing and Residence Life, Box 7315, NCSU, Raleigh, North Carolina 27695-7315.

The effective date of cancellation is the date notification is received by the Housing Assignments Office or the date the room is vacated, whichever is later.

APARTMENTS FOR MARRIED STUDENTS, SINGLE PARENTS, AND GRADUATE STUDENTS

The University operates 295 apartments in E. S. King Village for students with families, single parents and graduate students. The 1992 1993 rental was \$240 for a studio, \$250 for a one bedroom, and \$275 for a two bedroom apartment including water only (gas is included in studio units). This rate is subject to change on an annual basis. Information on availability and applications should be requested from Housing Assignments Office, 1112 Pullen Hall, Department of Housing and Residence Life, Box 7315, Raleigh, North Carolina 27695 7315.

OFF-CAMPUS HOUSING

Raleigh has a variety of privately owned apartments and houses available for rent to University students. A partial listing is located in the Housing Assignments Office, 1112 Pullen Hall. No listing is published because of the rapid turnover.

The University does not operate a trailer parking area; however, privately owned parks are available within a reasonable distance of the campus.

FRATERNITIES AND SORORITIES

Twenty of the 25 general college fraternities and four of the eight general college sororities chartered at the University maintain chapter houses. Thirteen of the fraternities and two of the sororities are housed on Fraternity Court, a University-owned project; the remaining fraternities and sororities are located throughout the immediate community.

Rental fees vary in fraternity and sorority houses depending on the individual chapter, but are approximately the same as the residence hall rates.

Academic Policies and Procedures

ACADEMIC ADVISING

Every regularly enrolled student is assigned for academic advising to a faculty member who is normally a member of the department which is, or is most likely to become, the student's major department.

Responsibilities of the Student

Students have the primary responsibility for planning their individual programs and meeting graduation requirements. This involves: (1) keeping up to date with University, school, and departmental curricular requirements through materials available from the faculty advisers or departmental coordinator of advising; (2) keeping informed of academic deadlines and changes in academic policies; and (3) consulting with the faculty adviser or departmental coordinator of advising during each registration period, following notification of academic warning status, and at other times as needed.

Responsibilities of the Faculty Adviser

Although students have the primary responsibility for planning their programs, faculty advisers are expected to: (1) be available for conferences at appropriate times and places about which their advisees have been informed; (2) provide accurate information about academic regulations and procedures, course prerequisites, and graduation requirements; (3) assist students in planning academic programs suited to their interests and abilities and their career objectives; (4) discuss with their advisees appropriate course choices in fulfilling curriculum requirements as well as possible consequences of various alternative course choices; (5) inform their advisees when the advisee's proposed course selections conflict with University academic or curricular regulations; (6) assist advisees with following proper procedures for such things as exceptions to the course drop deadlines, auditing a course before or after taking it for credit, taking a course under the credit by examination policy, registering for 19 or more credit hours, registering for CRC interinstitutional courses, or repeating a course previously passed; (7) refer their advisees for special testing or counseling as needed; and (8) assist their advisees in considering the appropriateness of academic adjustments where these become necessary in cases of serious injury or illness.

Responsibilities of the Coordinator of Advising

Each college or department has a coordinator of advising who is responsible for: (1) assigning, training, and supervising faculty advisers; (2) providing up to date, printed course and curriculum information for advisers and students; (3) reassigning to another adviser any student who so requests; and (4) assisting any student who wants to major in the coordinator's area of study but is ineligible at

the time to transfer into it. Students in this category keep their adviser in the department in which they are enrolled but consult additionally with the coordinator of advising for the department offering the curriculum in which they wish to enroll. Whenever appropriate, the coordinator will advise students that they should consider alternative curricula.

CLASSIFICATION OF STUDENTS

Regular undergraduate degree students are classified at the beginning of each semester and summer session. The required number of hours of each classification is:

<i>Classification</i>	<i>Semester Hours of Earned Credit</i>
Freshman (FR)	Fewer than 28
Sophomore (SO)	28 or more, but fewer than 60
Junior (JR)	60 or more, but fewer than 92
Senior (SR)	92 or more

Agricultural Institute students are designated as first (01) year if they have earned fewer than 28 semester credits and second (02) year if they have earned 28 or more semester credits.

Unclassified Students (UN) are those working for college credit but not enrolled in a degree-granting program. Admission as an unclassified student requires the recommendation of the dean of the school in which the student wishes to enroll. Unclassified students must meet the same entrance requirements as regular degree students and must meet the same academic requirements to continue. If, at a later date, unclassified students wish to change to regular degree status, their credits will be evaluated in terms of the requirements of their intended curriculum.

The **Special Student (SP)** classification includes Undergraduate Studies and Post Baccalaureate Studies students:

- (1) **Undergraduate Studies (UGS)** students are United States citizens who have not obtained a baccalaureate degree and who take courses but who are not currently admitted to a degree program. To be eligible to register as a UGS student, a person should either: (a) have acquired a high school diploma or a GED certificate; not have been suspended from any college or university (including NCSU) within the last three years; and not be a degree candidate at NCSU; or (b) be a high school student who has been recommended by his/her school and approved by the Undergraduate Admissions Office to take lower level courses. Visiting summer sessions students and visiting interinstitutional students do not necessarily have to meet the above criteria.
- (2) **Post-Baccalaureate Studies (PBS)** students are United States citizens who take courses beyond the baccalaureate degree but who are not currently admitted to a degree program. This classification is closed to international students with the following exceptions: (a) spouses of regularly enrolled NCSU degree students; or (b) students enrolled in special programs such as AID, FAO, etc., who are approved in advance by the International Student Office and the Graduate School.

All UGS and PBS students must register through the Office of Adult Credit Programs & Summer Sessions which is located in the Jane S. McKimmon Center for Extension and Continuing Education. *Persons found eligible to study as UGS or PBS students are not to assume that they have received formal admission to the University as either undergraduate or graduate degree candidates.* To become a degree candidate, formal application must be made through the Undergraduate Admissions Office or the Graduate School.

The maximum course load for all UGS and PBS students is two courses plus one physical education course each semester or summer session. They may enroll in any course offered by the University, provided they have satisfied any required prerequisites and space is available. The academic standards applicable to undergraduate degree candidates at the University, including the Suspension Policy, apply to UGS and PBS students.

SEMESTER COURSE LOAD

For undergraduate degree students the maximum course load is 21 credit hours a semester and two courses plus PE in a summer session. To carry more than the maximum, students must obtain the approval of their academic adviser and of their dean. Undergraduate students who propose to register for 19 or more credit hours a semester must obtain approval from their academic adviser. Students with a GPA of less than 2.0 are advised to carry no more than 16 credit hours a semester.

For Undergraduate Studies (UGS) and Post-Baccalaureate Studies (PBS) students the maximum course load is two courses plus PE in a regular semester or summer session. Exceptions must be approved by the Admissions Office for UGS students and by the Registrar for PBS students.

The minimum course load for full-time undergraduate degree students is 12 credit hours, except in their final semester when a lesser number may be taken if that is all the student needs to fulfill the requirements for a degree. In all cases, to receive financial aid a student must meet the minimum course load requirements of the appropriate funding agency.

The number of hours for which a student is officially enrolled is that number in which the student is enrolled for credit at the end of the second week of classes (i.e., the last day to withdraw or drop a course with a refund).

GRADING SYSTEM

<i>(Definition of Letter Grades and Grade Points)</i>		
<i>Grade</i>	<i>Definition</i>	<i>Grade Points Per Credit Hour</i>
A	Excellent	4
B	Good	3
C	Satisfactory ("Passing" for graduate students)	2
D	Marginal	1
F	Failing	0

(The following grades are not used in the calculation of grade point averages.)

S	Satisfactory (Credit only and certain other courses)
U	Unsatisfactory (Credit only and certain other courses)
CR	Credit by Examination or Advanced Placement
IN	Incomplete
LA	Temporarily Late
AU	Audit
NR	No Recognition Given for Audit
W	Withdrawal or Late Drop

Explanation of Letter Grades

D Marginal. This grade will be used to recognize that a student's performance was marginal but clearly better than that of students who receive an F.

F Failing. This grade will be used to indicate that the student has failed the course.

U—Unsatisfactory. This grade is used to indicate that the student is not to receive credit for a credit-only or other course for which the passing grade would be S (*Satisfactory*).

CR—Credit. This grade is used by the registrar to indicate course credit received by examination or advanced placement as certified by appropriate departments or schools. This grade shall be awarded only when the advanced placement testing indicates that the quality of the student's work in the course would have been expected to be of C or higher level.

IN—Incomplete. This is a temporary grade. At the discretion of the instructor, students may be given an IN grade for work not completed because of a serious interruption in their 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 deserving of an F. 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.*

An IN grade must be made up by the end of the next regular semester (not including summer sessions) in which the student is enrolled, provided that this period is not longer than twelve months from the end of the semester or summer session in which the work was due. In the event that the instructor or department offering the course is not able to provide a student with the opportunity to make up the incomplete work by the end of the next regular semester in which the student is enrolled or within twelve months, whichever is shorter, the instructor or department offering the course must notify the student and the Department of Registration and Records of the date of the extended deadline for removing the IN grade.

Any IN grade not removed by the end of the next regular semester in which the student is enrolled or by the end of twelve months, whichever is shorter, or by the

extended deadline authorized by the instructor or department offering the course and recorded by the Department of Registration and Records will automatically become a Failing (F) grade and will count as a course attempted.

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.

LA—Temporarily Late. The LA is an emergency symbol to be used only when grades cannot be reported by the teaching department or the professor on time. The LA differs from the IN grade in that the student receiving the LA has completed the work of the course including the examination.

AU—Audit. This is used to indicate that a student has successfully audited a course by attending class regularly and completing the instructor's requirements.

NR No Recognition Given for Audit. This grade is given if the instructor concludes that the auditor has gained little from the course due to poor attendance or failure to fulfill the instructor's requirements.

W—Withdrawal or Late Drop. The W will be used to indicate on all students' academic records all courses for which they have received official approval to drop or from which they have received official approval to withdraw after the deadlines for dropping 100- through 400-level or 500- and 600 level courses.

GRADE POINT AVERAGE

The number of credit hours attempted in a semester or summer session (for which grades of A, B, C, D, or F are received) is divided into the total number of grade points earned to arrive at the Grade Point Average (GPA). The Grade Point Average will be calculated to three decimal points.

For example, if a student takes 16 credit hours, earning an A in two 3 credit courses, a B in one 3 credit course, and a B in one 2 credit course, a C in a 3 credit course, and an F in a 2 credit course, the grade point average would be:

6 (credits of A)	x 4 (grade points per credit hour)	24
5 (credits of B)	x 3 (grade points per credit hour)	15
3 (credits of C)	x 2 (grade points per credit hour)	6
2 (credits of F)	x 0 (grade points per credit hour)	0

45

The total number of grade points earned (45) divided by the number of credit hours attempted (16) equals the grade point average. In this case 2.813.

ACADEMIC HONORS

High ranking students in their freshman year are eligible for membership in **Phi Eta Sigma** and **Alpha Lambda Delta**. Both of these national scholastic honoraries require a 3.5 semester grade point average or better during the first semester or a cumulative average of 3.5 for both semesters during the freshman

year. Juniors ranking in the top three percent of their class, seniors ranking in the top sixth of their class and outstanding graduate students are eligible for election to membership in **Phi Kappa Phi**, a national scholastic honor society.

Semester Dean's List—A full-time undergraduate student who earns a semester average of 3.5 or better on 12 to 14 hours of course work for which grade points are earned or a semester average of 3.25 or better on 15 or more hours of course work for which grade points are earned shall be placed on the Dean's List for that semester.

Students are not eligible for the Dean's List in any semester in which they receive an NC or IN grade. When IN grades are resolved, however, students who are otherwise eligible shall be added retroactively to the Dean's List for that semester. Dean's List recognition shall be noted on the student's semester grade report and permanent academic record.

Graduation with Honors—Undergraduate degree honor designations are:

Cum Laude for GPA 3.25 through 3.499

Magna Cum Laude for GPA 3.5 through 3.749

Summa Cum Laude for GPA 3.75 and above

To be eligible for degree honor designations students must have completed at least two semesters and at least 30 credit hours at NCSU.

Valedictorian, Salutatorian, and Highest Ranking Scholar in a College—

To be eligible for consideration as valedictorian, salutatorian, or highest ranking scholar in a college, an undergraduate student must have received at least 100 academic credits at NCSU (including credit by examination, advanced placement credit, and S U courses.) These 100 credits may include no more than 20 transfer credits through programs officially sponsored by NCSU. Specifically, these programs are Cooperating Raleigh Colleges, National Student Exchange, International Student Exchange, NCSU sponsored study abroad programs, and the affiliated hospital programs in Medical Technology.

All students whose accumulated grade point averages, based on all courses attempted at NCSU, make them eligible for one of these honors shall be so recognized. That is, in the case of ties, more than one student will receive the honor. However, in the case of ties for valedictorian, no salutatorian will be recognized.

GRADE REPORTS

At the end of each semester or summer session, Registration and Records issues a grade report showing all grades earned during that grading period, as well as the record of all previous work taken at this University.

Address Information—As part of the registration process students will be asked to verify and/or complete an address form giving a mailing address to which grade reports and other University correspondence will be mailed. Students have the choice of having their grade reports sent either to their parents or guardians, or directly to themselves.

Change of Name or Address—It is the student's responsibility to inform Registration and Records of any changes in name or address. Failure to do this may prevent prompt delivery of important University correspondence. News stories about Dean's List students are sent to North Carolina newspapers based on hometown information furnished by Registration and Records.

ACADEMIC SUSPENSION POLICIES

A. Suspension Policy for students enrolled prior to 1990 summer sessions.

All undergraduate students, including Lifelong Education students, who were enrolled in NCSU at any time prior to the 1990 summer sessions, will be subject to the Suspension Policy set forth below, until the 1994 fall semester. Beginning with the 1994 fall semester, all undergraduate students will be subject to the Suspension Policy stated subsequently under B.

At the end of any regular semester or summer session a notice of "**Academic Warning**" shall be placed on the grade report of any undergraduate student who is not suspended at that time but whose cumulative grade point average for courses taken at NCSU is less than 2.0.

Academic Warning I shall mean that a student's cumulative grade point average at NCSU is below the 2.0 minimum required for graduation but greater than that which would result in Academic Warning II on the graduated grade point average suspension policy.

Academic Warning II shall mean that a student's cumulative grade point average at NCSU is below the minimum required for retention under the next step in the graduated grade point average suspension policy.

Suspension. All undergraduate students in any classification must maintain a grade point average which will assure that they are making progress toward the 2.0 grade point average minimum requirement for graduation. Students will be suspended at the end of any regular semester in which they do not meet the minimum required cumulative grade point average on all courses taken at NCSU according to the following graduated schedule:

Credit hours attempted at NCSU plus credit hours transferred	Minimum required cumulative grade point average on all courses taken at NCSU
1 27	No requirement
28 59	1.25
60 91	1.55
92 123	1.75
124 or more	1.95

Students whose hours attempted at NCSU plus transferred hours total 160 or more will not be permitted to register for courses in a subsequent regular semester until their academic record has been reviewed by their college dean in consultation with their major department or program. Students who in the judgment of their college dean are making appropriate progress toward the fulfillment of their degree requirements may be authorized to continue for an additional semester without conditions or with conditions specified in writing.

Authorization for these students to continue to register in subsequent semesters may be made by the college dean following similar reviews.

The preceding statements notwithstanding, students shall not be suspended at the end of their first regular semester at NCSU.

Suspended students who are attending a summer session for the purpose of improving their academic standing in order to regain eligibility for readmission to NCSU will have their suspension continued unless their performance in that summer session is sufficient to make them eligible for automatic readmission. A student who is not in a suspended status prior to a summer session will not be suspended because of performance in that summer session.

B. Suspension Policy for students enrolled for the first time in the 1990 summer sessions or thereafter. Beginning with the 1994 fall semester, this policy will be in effect for all students.

All undergraduate students, including Lifelong Education students, who enroll in NCSU for the first time in the 1990 summer sessions or thereafter will be subject to the Suspension Policy set forth below. Beginning with the 1994 fall semester, all undergraduate students, regardless of when they first enrolled in NCSU, will be subject to this policy.

At the end of any regular semester or summer session a notice of "**Academic Warning**" shall be placed on the grade report of any undergraduate student who is not suspended at that time but whose cumulative GPA for courses taken at NCSU is less than 2.0.

Academic Warning I shall mean that a student's cumulative GPA at NCSU is less than 2.0 but greater than that which would result in Academic Warning II on the graduated retention schedule. Academic Warning I shall be assigned to those students who have:

- 1-35 credit hours attempted with a cumulative GPA greater than or equal to 1.6 but less than 2.0
- 36-47 credit hours attempted with a cumulative GPA greater than or equal to 1.7 but less than 2.0
- 48-59 credit hours attempted with a cumulative GPA greater than or equal to 1.8 but less than 2.0
- 60-71 credit hours attempted with a cumulative GPA greater than or equal to 1.9 but less than 2.0

Academic Warning II shall mean that a student's cumulative GPA at NCSU is below the minimum required for continuation under the next step in the graduated retention schedule. It shall be assigned to those students who have:

- 1-35 credit hours attempted with a cumulative GPA greater than or equal to 1.5 but less than 1.6
- 36-47 credit hours attempted with a cumulative GPA greater than or equal to 1.6 but less than 1.7
- 48-59 credit hours attempted with a cumulative GPA greater than or equal to 1.7 but less than 1.8

60-71 credit hours attempted with a cumulative GPA greater than or equal to 1.8 but less than 1.9

72-83 credit hours attempted with a cumulative GPA greater than or equal to 1.9 but less than 2.0

The minimum eligibility standard for continued enrollment for any undergraduate student is defined as maintaining the required grade point average (GPA) for the number of credit hours attempted at NCSU plus transferred credit hours according to the following retention schedule:

Credit hours attempted plus transferred credit hours	Minimum cumulative GPA required on all courses taken at NCSU
1-35 hours	1.5
36-47 hours	1.6
48-59 hours	1.7
60-71 hours	1.8
72-83 hours	1.9
more than 83 hours	2.0

“Probation” will be assigned to those students who fail to achieve the minimum cumulative GPA required under the retention schedule. Students on probation will be allowed to enroll for one additional regular semester for the purpose of achieving the minimum cumulative GPA as required under the retention schedule. Students on probation are not considered to be in good academic standing.

Probation signifies that serious deficiencies are present in a student’s academic performance. Students on probation or Academic Warning II will be required to have their academic records reviewed by their departmental academic adviser and the associate dean in their respective colleges before the end of the second week of the probation semester.

Suspension will be assigned to those students who fail to achieve the minimum cumulative GPA required under the retention schedule following a semester on probation.

Suspended students who are attending a summer session for the purpose of improving their academic standing in order to regain eligibility for readmission to NCSU will have their suspension continued unless their performance in that summer session is sufficient to make them eligible for automatic readmission.

Students will not be suspended at the end of a summer session nor at the end of their first regular semester nor until they have attempted 12 or more credit hours at NCSU.

Note: “Credit hours attempted” in this policy means the total credit hours attempted at NCSU plus transferred credit hours from other institutions.

WITHDRAWAL FROM THE UNIVERSITY

An official withdrawal means that a student is allowed to drop, without academic penalty, all of the courses for which he/she is registered in a given semester or summer session. For each semester, the official academic calendar indicates

the dates for withdrawing with a refund (less a registration fee) and for withdrawing without academic penalty. After the refund deadline, prorated refunds will only be authorized by the Fee Appeals Committee for medical or unusual hardship cases. After the official withdrawal period, withdrawals without academic penalty are granted only for unforeseeable, unavoidable, and exceptional grounds.

The student's record will show the date of withdrawal followed by a list of the registered courses marked with a "W", but academic grades and quality points are not recorded. Undergraduate degree candidates and unclassified students initiate the official withdrawal process with the Counseling Center, 2000 Harris Hall. Lifelong Education (UGS and PBS) students initiate their withdrawal process with the Office of Adult Credit Programs & Summer Sessions, 145 McKimmon Center.

Notification of or approval by a degree student's dean may be required for a withdrawal within the official period. In cases of withdrawals granted for hardship reasons, the dean's approval, and in some cases, approval of the advisor and or coordinator of advising is required. Cases of withdrawals granted for medical or emotional reason must be approved by the Counseling Center after evaluation of available documentation or the special situation.

Parental approval to withdraw may be required for single students who are under eighteen. Withdrawal during a semester does not constitute a break in residency if the student returns the semester immediately following. In cases where a student has obligations to the University for such matters as housing, meal plan, and financial aid, the withdrawal will not be processed by Registration and Records until the student has officially cleared the obligations. It is highly recommended that students considering withdrawal consult their faculty advisor or departmental coordinator of advising before initiating the withdrawal process.

READMISSION OF FORMER OR SUSPENDED DEGREE STUDENTS

A *Former Degree Student Returning* is one who was not in attendance at all during the fall or spring semester prior to applying for readmission. All former degree students returning, both graduates and undergraduates, must apply for readmission to the Department of Registration and Records, NCSU, Box 7313, Raleigh, North Carolina 27695 7313. Readmission applications should be submitted as soon as possible but no later than 30 days prior to the date of desired enrollment. Former students returning should be aware that enrollment restrictions may be imposed at any time which may affect their readmission. A student who received a bachelor's degree must (a) apply for admission to the Graduate School; or (b) register as a Post Baccalaureate Studies (PBS) student through the Office of Adult Credit Programs & Summer Sessions; or (c) apply for readmission as a candidate for a second bachelor's degree or for a professional degree or as an undergraduate Unclassified Student. Registration alone is not sufficient to enable the student to be readmitted.

Readmission of Former Degree Students

Students who were eligible to continue at NCSU at the time of their leaving are eligible to be readmitted to their former program provided they have a grade point average of 2.0 on all courses taken at NCSU and provided there is space available.

Students who were eligible to continue at NCSU at the time of their leaving and who have a grade point average of less than 2.0 on all courses taken at NCSU may be determined to be eligible for readmission through one of the following procedures:

- a. Students whose grade point average on all courses taken at NCSU is less than 2.0 but greater than that required for continuation under the next step in the graduated suspension policy are on Academic Warning I. Application for readmission from former students who are or would be on Academic Warning I will be reviewed.
- b. Students whose grade point average on all courses taken at NCSU is less than that required for continuation under the next step in the graduated suspension policy but who are not suspended are on Academic Warning II. Applications for readmission from former students who are or would be on Academic Warning II will be reviewed.
- c. Former students whose grade point average on all courses taken at NCSU is such that they were or would have been suspended will have their applications for readmission reviewed by the University Admissions Committee. If readmitted, their academic status will be Academic Warning II.

Former students whose hours attempted at NCSU plus transferred hours total 160 or more will have their application for readmission reviewed in consultation with the student's dean. If readmitted, they will be notified of any applicable conditions with regard to their making appropriate progress toward fulfillment of degree requirements.

Readmission of Suspended Students

- a. *Automatic Readmission.* Students who are academically suspended may do one or both of the following: (1) attend any number of summer sessions at NCSU; (2) enroll in NCSU courses through Independent Studies (formerly called correspondence courses); (3) enroll in NCSU Courses via Cable or Courses via Videocassette.

Note: Courses taken at an institution other than NCSU or offered by some other institution through Independent Studies do not affect a student's suspension status at NCSU.

When by one or more of these methods a suspended student has improved his or her academic standing to the extent that the student is no longer academically suspended, that student becomes automatically eligible for readmission to a regular semester and no letter of appeal to the University Admissions Committee by the student is necessary.

- b. *Appeal to the University Admissions Committee.* A student who is academically suspended, who is ineligible for automatic readmission as described above, and who feels that extenuating circumstances contributed to that suspension, may appeal to the University Admissions Committee for readmission to a regular semester. A letter must be written to the Committee stating:
1. the reasons for former academic difficulty with an explanation of extenuating circumstances;
 2. why the student believes he or she can now successfully meet all degree requirements within a reasonable length of time;
 3. the summer sessions, Independent Studies, or NCSU off campus courses that have been completed; and
 4. the address and telephone number to be used for notification of the Admissions Committee's decision.

Note: The Admissions Committee will not act on the appeal of any student currently enrolled in any summer session, Independent Studies, or off-campus course. Suspended students whose hours attempted at NCSU plus transferred hours are equal to or greater than 160 must be recommended by their deans for continuation or readmission before the Admissions Committee will review an appeal.

The letter should be mailed to: Department of Registration and Records, Attention: Admissions Committee, North Carolina State University, Box 7313, Raleigh, North Carolina 27695 7313. The letter must reach the Department of Registration and Records by the following deadlines:

1. *no later* than two weeks before the first day of classes for the fall semester for students who did not attend summer school or who attended first summer session only;
2. *no later* than one week before the first day of classes for the fall semester for students who attended second summer session; and
3. *no later* than one week before the first day of classes for the spring semester.

Note: The Admissions Committee meets prior to the first day of classes. All material must be received in accordance with the above dates.

- c. *Appeal to the University Admissions Committee by Students Who Have Not Been Enrolled at NCSU for Three or More Years (Contractual Readmission)*

After not being enrolled at NCSU (excluding summer sessions, Independent Studies, and NCSU off-campus courses) for a continuous three-year period or longer, a student whose former academic record at NCSU was such that he or she was suspended or would have been suspended or placed on Academic Warning II under current policies may petition the University Admissions Committee for contractual readmission.

The Committee will decide each case on its individual merits with special regard to the student's written appeal, the productive use of the three or more intervening years, evidence of motivation and achievement based on any academic work done during those three or more years, and a supporting letter from the department offering the curriculum into which the student requests admission. This letter must contain a proposed plan of study agreed

to and signed by the student, the department head, and the dean. If the curriculum into which the student requests admission is different from that in which the student was last enrolled, the petition to the Admissions Committee must also be accompanied by a Curriculum Change Form approved by the accepting dean.

If a contractual readmission is approved, the following conditions will apply:

1. The student's entire academic record at NCSU will be recorded on any subsequent transcript, including a GPA on all work attempted at NCSU;
2. For courses attempted prior to readmission, only work of "C" or better will count toward fulfilling graduation requirements, providing that such courses meet current curriculum requirements;
3. For purposes of suspension and graduation, a second GPA will be calculated based only on courses that are attempted after readmission. Total hours for graduation and suspension will be based on all work at NCSU after readmission plus former work of C or better that is acceptable to the department plus hours transferred from other institutions;
4. The student must maintain an overall GPA of 2.0 or better on all courses attempted after readmission;
5. Students who fail to achieve an overall GPA of 2.0 required in #4 above will lose their contractual readmission status. Their status for subsequent work as a degree student at NCSU shall be determined on the basis of total hours attempted at NCSU plus transferred hours, and their GPA calculated using all courses attempted at NCSU; and
6. A student may be readmitted under this option only once.

Intra-Campus Transfers (curriculum change)

A former student returning who desires a change of curriculum must have his or her records transferred to the new college and submit a properly validated Curriculum Change Form to the Department of Registration and Records, 1000 Harris Hall, before readmission can be processed.

TRANSFER CREDIT

Transcripts of college course credit for new transfer students and for NCSU students who have taken course work at another institution are evaluated by the dean of the appropriate school to determine how the work applies toward fulfilling the graduation requirements of each student's intended curriculum.

Students admitted to an NCSU undergraduate degree program who wish to take courses at another institution must obtain prior endorsement from their academic department and prior written approval from their school dean in order to insure that the transfer credits will apply toward fulfilling specific graduation requirements.

Transfer credit is not recorded on former students' permanent records until after they have been readmitted and have reenrolled.

REPEATING COURSES

Students who repeat a course, regardless of the grade previously made, will have both grades counted in their cumulative Grade Point Average, except as indicated below. Undergraduate students may be allowed as many semester hours as are appropriate in the departmental curriculum for courses that: (1) are titled seminar, special problems, special topics, independent studies, or research (usually numbered 490 499 or 590 599); and (2) cover topics different from those studied when the courses were previously taken. Unless a course satisfies one or the other of the above conditions, the semester hours will be counted only once toward the number of hours required for graduation even though students repeat and pass the course both times.

The adviser's approval is required for students to repeat any course previously passed with a C; no approval can be given for a grade of A or B. Nor will it be given when: (1) students wish to repeat a lower division course that they have passed with a grade of C or better after having successfully completed an advanced course covering the same material; (2) students wish to repeat a lower level course that they have passed with a C or better which is a prerequisite for an advanced course that they had already successfully completed; (3) students wish to take an introductory course after they have successfully completed an advanced course dealing with similar material; or (4) students wish to repeat a course in which they have an outstanding grade of IN.

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.

For information, contact the Department of Registration and Records, 1000 Harris, (919) 515-2572.

REPEATING COURSES WITHOUT PENALTY

A student is eligible to repeat without penalty a maximum of three courses (but not more than 12 credit hours) at the 100- and or 200-level provided all of the following criteria have been satisfied: (1) each course to be repeated was completed for the first time in the 1984 fall semester or during any regular semester or summer session thereafter at NCSU; (2) the student received a grade of D or NC F on each course to be repeated; (3) a student may not repeat without penalty a lower division course after having successfully completed an advanced course dealing with the same subject matter; (4) The student can receive the benefits of this policy only once for each course repeated; and (5) the repeat without penalty policy will not change the student's recorded grade point average for the semester in which the course was originally taken, however, it does affect the student's cumulative grade point average. *Repeating a course does not retroactively change the probationary status.*

To repeat a course without penalty under this policy means that an eligible student who completes for the second time a 100 or 200-level NCSU course may have the grade points and the credit hours attempted and earned on the first completion of the course removed from the calculation of his or her cumulative GPA and from the calculation of the total hours attempted under the provisions of

the suspension policy. *This policy applies only to courses graded A, B, C, D, or NC F on both the first and second completions.*

Note: A student's grade point average that is modified as a result of a course repeat without penalty action may not be the grade point average recognized by other institutions. Students who intend to apply for admission to another institution for graduate, professional, or continuing undergraduate studies are encouraged to inquire about each institution's method for calculating a prospective student's grade point average.

For additional information, contact the Department of Registration and Records, 1000 Harris Hall, (919) 515-2572.

CREDIT BY EXAMINATION

Undergraduate students currently registered at NCSU (degree, unclassified, or lifelong education) may request an examination for course credit in a course whether enrolled in that course or not, under the conditions described below. Students must initiate a request with their adviser (except when a teaching department awards credit based upon group testing for placement purposes). Should the adviser approve, the student must arrange for the examination with the department offering the course. The department may administer the examination in any manner pertinent to the materials of the course. Departments are encouraged to offer credit by examination in all courses but have the prerogative of excluding certain courses which are demonstrably unsuited for credit by examination.

The academic standards for credit by examination will be commensurate with the academic standards for the course. If a student's performance on the examination is judged to be of C or higher quality, the department will notify the Department of Registration and Records on a Grade Change Report that the student has received Credit by Examination for the course. The Department of Registration and Records will enter the appropriate number of credit hours on the student's permanent academic record. Credits earned through Credit by Examination are not used in the computation of a student's grade point average.

The Department of Registration and Records will post course credit by examination to a student's permanent academic record only if that student is currently registered at NCSU. However, if the course credit by examination would enable a student to complete the requirements for a degree, that student would not have to be registered in order to receive the credit.

If a student fails to achieve C or higher quality work on an attempted credit by examination, no action is required other than the department's notifying the student. However, that student is not eligible for another such examination in the same course.

Once a student has failed a course or has completed for credit or audit more than fifty percent of a course, the student may not attempt credit by examination for that course. Under unusual circumstances, exceptions may be made upon the written recommendation of the student's adviser and the approval of the department offering the course. A student who receives credit by examination in a course in which that student is currently enrolled must officially drop that course no later than mid-semester.

CREDIT BY EXAMINATION THROUGH INDEPENDENT STUDIES

Persons who are not currently enrolled on campus and who have gained through study or experience, knowledge of the content of undergraduate credit courses offered through Independent Studies may (with the approval of the Independent Studies staff and the academic department offering a course) receive credit for that course by special examination. Students may request approval to attempt credit by examination by completing and submitting a form available from Independent Studies, The University of North Carolina, Box 1020, The Friday Center, Chapel Hill, North Carolina 27599 1020, (919) 962-1107.

Currently enrolled students are not eligible for credit by examination through Independent Studies. These students should go directly to the appropriate academic department to request credit by examination under the regular procedures in effect on campus.

CREDIT-ONLY OPTION FOR FREE ELECTIVE COURSES

Each undergraduate student has the option to count toward graduation requirements a maximum of 12 semester hours in the category of credit-only courses (exclusive of courses authorized to be graded on Satisfactory Unsatisfactory basis). The student may select as credit-only any course offered by the University except those in Military Science and Aerospace Studies. Selected course must be included under the free elective category of the specified curriculum in which the student is enrolled. The student will be responsible for attendance, assignments, and examinations.

The student's performance in a credit-only course will be reported as S (satisfactory grade for credit-only course and given when course work is equivalent to C or better) or U (no-credit grade for credit-only course). The grade for a credit-only course will have no effect on the student's Grade Point Average. The course and its grade will be counted in the cumulative hours attempted. *Credit only courses do not count in the calculation of eligibility for the Semester Dean's List, which requires either twelve hours or fifteen hours of course work for which grade points are earned.*

Lifelong Education students may take on a credit-only basis any course for which they satisfy prerequisites.

AUDITS (UNDERGRADUATE)

Students wishing to audit a course before or after taking it for credit must have the approval of their adviser and of the department offering the course. Auditors 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 such requirements should be clearly explained in writing to the auditor at the beginning of the semester. Should the instructor conclude that poor attendance has resulted in an auditor's gaining little from the course, the instructor should mark NR (no recognition given for an audit) on the final grade report. Students who have taken a course for audit may, with their adviser's approval enroll in the course for credit during a subsequent semester or summer session.

For tuition cost purposes, audits are treated as full credit value. For all other purposes, hours of audit do not count in calculating undergraduate course loads.

Note: Veteran's benefits are governed by Veterans Administration regulation concerning audits. Public Law 94-502 (G.I. Bill) and Public Law 64 (sons and daughters of deceased or disabled veterans) consider only courses being taken for credit when determining a student's load for benefit purposes. For information, contact the Veterans Affairs Office, 1000 Harris Hall, (919) 515 3048.

INTRA-CAMPUS TRANSFERS

Undergraduate students wishing to change from one curriculum to another must report to the dean's office of the college offering the curriculum in which entrance is desired and request acceptance into the new college or curriculum.

A student who has attempted fewer than twelve credit hours at NCSU may transfer to another curriculum provided that student meets the admission requirements of the intended new curriculum. A student who has attempted twelve or more credit hours at NCSU may transfer to another curriculum provided that student is eligible to do so under the intra-campus transfer policy which pertains to the intended curriculum.

If acceptance is approved, a Curriculum Change Form will be issued, bearing the signature of the accepting dean. If the former curriculum was in a different college, the Curriculum Change Form should be submitted for the signature of the releasing dean with the request that all records be transferred to the new college and department. From the standpoint of advising, registration, and adding and dropping courses, the student is considered to be in the new curriculum as soon as the Curriculum Change Form is completed and filed with the Department of Registration and Records and the records of the student have been transferred to the new department.

Code of Student Conduct

All students who enroll at NCSU are required to adhere to the Code of Student Conduct. This code . . . "sets out the kind of behavior that disrupts and inhibits the normal functioning of the University, and what action it will take to protect the community from such disruption." Academic and Non-Academic Misconduct, both on and off campus are addressed in the Code. Students charged and found guilty of violating the Code of Student Conduct will receive sanctions that may range from an oral reprimand to expulsion from the University.

Student Services

ACCIDENT AND HEALTH INSURANCE

The University offers students an accident and health insurance program. The insurance covers the surgical, accident, and hospital needs of participating students as a supplement to the Student Health Service. Each year complete information is available to students at the start of the fall semester.

CAREER PLANNING AND PLACEMENT CENTER

The center offers assistance to all students at the University on a year round basis. Advice on the relationship of professional goals to various programs of study and assistance in identifying individual aptitudes and abilities affecting career potential are available. Students are encouraged to participate in a Career Planning Workshop in the freshman or sophomore year.

The center coordinates job interviews between students and employer representatives. Seniors are urged to use this placement service for interviewing with potential employers. The staff also recommends contacts with employers not scheduled to visit the campus.

COUNSELING

The Counseling Center assists individuals in gaining a better understanding of themselves. Psychologists, professional counselors, and psychiatrists are available to work with students who desire assistance with concerns such as: choosing a career; academic planning; identifying and overcoming educational difficulties; developing greater self-understanding; developing more satisfying personal relations; and coping with stress or emotional crisis. All counseling is strictly confidential.

In addition to one-to one and group counseling for individuals and couples, workshops are offered throughout the year in a variety of areas, including vocational exploration, study skills, anxiety-reduction, and assertive behavior.

Counseling services are available without cost to all enrolled NCSU students, and some services are available to prospective students. Appointments may be scheduled by calling (919) 515-2424 or in person at 2000 Harris Hall.

FOOD SERVICE

University Dining, the University's food service department, has 13 campus locations to serve students, faculty, and staff. Awarded the Ivy Award by *Restaurant & Institutions* magazine in 1988, University Dining is recognized nationally for exciting and innovative concepts in campus dining.

The Fountain Dining Hall, located on West Campus serves as the main hub for the meal-plan program. The Dining Hall offers its patrons an all-you-can eat menu in a modern, comfortable atmosphere that breaks from the traditional cafeteria-style service. The Dining Hall is open seven days a week, with brunch and dinner served on weekends. A registered dietician is on staff to assist with dietary restrictions and to provide nutritional or diet counseling.

Meal Plans. *Freshmen who live in the residence halls are required to participate in one of seven University Dining meal plans, each tailored to meet different needs. All seven meal plans are designed with both structure and flexibility. The structured element of the program is a set number of meals served in an all-you-can-eat fashion in the main Dining Hall. The flexible element is a Cash-Points system. Part of the meal plan purchase price is directly converted to a non refundable Cash-Points account that can be used only at University Dining locations on campus. Cash-Points are a dollar-for-dollar equivalence built into each meal plan to allow students the flexibility of eating meals away from the*

Dining Hall. The meal program is designed to allow students to choose the number of structured meals and the amount of flexible Cash-Points.

University Dining takes pride in offering quality food and services designed specifically to meet the wants and needs of students. These seven meal plans provide students with varied menu choices and the utmost in convenience. *For more information on meal plans contact the AllCampus Office, West Dunn Building, (919) 515 3090.*

HANDICAPPED STUDENTS

Students requiring special assistance because of visual, hearing, or motor handicaps should contact Handicapped Student Services, NCSU, Box 7312, 2000 Harris Hall, Raleigh, North Carolina 27695-7312, (919) 515-7653. Interpreter, tutorial, notetaker and/or reader services are available by contacting the center.

Direct services for all learning disabled students, such as educational counsel ing and arrangements for appropriate academic support, can also be initiated by Handicapped Student Services.

Those students needing special assistance in scheduling courses should make contact as far as possible in advance of preregistration deadlines.

HEALTH

The University seeks to safeguard the health of the students in every way possible. The Student Health Service, located in Clark Hall, offers medical care to students on an outpatient basis. The facility is staffed by full time physicians, registered nurses and other medical support personnel.

The Health Service is open Monday-Friday for outpatient medical care during fall and spring semesters (excluding breaks). Patients are seen by appointment. Weekend clinic and hours after 5:00 p.m. vary, so students are encouraged to call (919) 515 2563 for operating hours. Only weekday hours are offered during summer sessions. Physicians maintain regular office hours Monday-Friday and are on call at other times.

All registered students pay a medical fee which covers outpatient professional services; i.e., visits to a nurse or physician, routine laboratory procedures and some medications available in the student pharmacy. There is a nominal charge for x-rays, some lab tests, allergy injections, prescription medications and special clinics. Students are responsible for the cost of laboratory tests and x rays which must be performed by an off campus agency, medications not available in the student pharmacy, and expenses incurred when referred to an off-campus physician or hospital.

All health and medical information is confidential and is not divulged to anyone without the written consent of the patient.

Health Educators offer a variety of information, programs, and services to students. Health topics include weight control, alcohol and drug education, stress management, first aid, sexually transmitted diseases, women's issues, and more.

LAUNDRY AND DRY CLEANING

The University operates a laundry and dry cleaning facility on campus at reasonable prices. Branch offices are located in the residence halls for the convenience of the students.

LINEN RENTAL PROGRAM

The NCSU Laundry offers a special linen rental package to incoming students. The Laundry will provide two sheets, three towels, and a crisp pillow case each week.

Linen Rooms are located in Becton, Bowen, Lee, Owen, Syme, and at the main Laundry on Yarborough Drive. Throughout the school year, the Linen Rooms in the residence halls are open five days a week to accommodate student needs for clean linen.

CLOTHESLINE PROGRAM

The NCSU Laundry and Dry Cleaners also offers the CLOTHESLINE Program, which provides wash dry and fold service for 135 pounds of laundry, wash and press service for 75 shirts or blouses, and dry cleaning of 15 items per semester. It is a convenient way to keep clothes clean and neat, and payment is only required once at the beginning of the school year.

In addition to bringing laundry to the main facility on Yarborough Drive, CLOTHESLINE members may drop off and pick up laundry and cleaning at one of the linen rooms located in the residence halls mentioned above.

NCSU BOOKSTORES

The official campus source for all course books is NCSU Bookstores, consisting of the main store, located on East Dunn Avenue, and the North Campus Shop, located in the lower level of Erdahl Cloyd Annex of the D. H. Hill Library. At the main store, the book division provides textbooks, fiction, non fiction, technical and reference titles, publishers' overstock and remainders, college outlines, paperbacks, book reviews, periodicals, and calendars. The merchandise division carries school supplies, personal computers with accessories and supplies, art and engineering supplies, greeting cards, health and beauty aids, imprinted sportswear, souvenirs, and convenience items. Special orders are accepted for books and merchandise. Purchases may be charged by VISA, MasterCard, Discover, or AllCampus Money Card. During the opening of fall and spring semesters, the main store is open specified evenings, in addition to each Tuesday evening and Saturday when classes are in session. North Campus Shop specializes in computer supplies, sale books, magazines, college outlines, greeting cards, souvenirs, gifts, and convenience items. The entire operation of NCSU Bookstores is completely self-supporting, with its annual surplus transferred to NCSU Scholarship Fund.

TRANSPORTATION

All vehicles parking on campus during the hours of 7:30 a.m.-5:00 p.m., Monday through Friday, must display an appropriate NCSU permit. Freshmen residents and off-campus students living within a one mile radius of campus are not eligible for campus parking permits. Permits are distributed through a year-round registration process. As permits become available throughout the year, they are assigned according to a "wait list." Transportation alternatives include the University's Wolfline bus service, motorcycles, mopeds, bicycles, and carpools.

Wolfline operates when classes are in session, Monday through Friday. All Wolfline buses travel along designated routes and stop at signed Wolfline bus stops. A valid student AllCampus Card is all that is required to ride the bus. Route and schedule brochures are available at D. H. Hill Library, the Student Center, NCSU Bookstores, and the Division of Transportation. The citywide bus service, Capital Area Transit (CAT), is available for students living throughout Raleigh.

Bicycling offers an inexpensive alternative. Bicycle registration is required and will assist in recovery if the bicycle is lost or stolen. Bicycles may be registered with the Division of Transportation or Public Safety. Residence halls also register bicycles for their residents.

For more information on parking and transportation, contact Division of Transportation, NCSU, Box 7221, Raleigh, North Carolina 27695-7221, (919) 515-3424.

Student Activities

The University makes every effort to provide surroundings which are pleasant and conducive to intellectual growth. In addition, a wide variety of athletic, cultural, and social opportunities are available to students. Through the services and activities affiliated with campus life, as well as through extracurricular organizations and functions, students at NCSU may acquire experience in group leadership and community living to supplement and enrich their education.

STUDENT GOVERNMENT

Every NCSU student is a member of a community which exercises executive, legislative, and judicial authority in matters of student life. Students have a voice in government through participation in campus-wide elections of officers, legislators, and judiciary members. For more information, contact Student Government, (919) 515-2797.

CLUBS AND SOCIETIES

Honorary. University-wide honorary societies include Golden Chain, senior leadership; Thirty and Three, junior leadership; Phi Eta Sigma and Alpha

Lambda Delta, freshman scholarship; Gamma Beta Phi, scholarship and service; and Phi Kappa Phi, junior, senior, and graduate student scholarship.

Professional and Technical Organizations. The colleges and departments sponsor or supervise a large number of professional and technical societies and clubs. These organizations contribute substantially to students' professional and social growth.

Fraternalities and Sororities. Fraternities and sororities are included in the many educational programs at NCSU. Fraternal groups provide opportunities for students to develop skills of social interaction, sensitivity to the rights and needs of others, and leadership and management experience.

Twenty-five national general college fraternities have chapters at NCSU. They are Alpha Gamma Rho, Alpha Phi Alpha, Delta Chi, Delta Sigma Phi, Delta Upsilon, FarmHouse, Kappa Alpha, Kappa Alpha Psi, Kappa Sigma, Lambda Chi Alpha, Omega Psi Phi, Phi Beta Sigma, Phi Delta Theta, Phi Kappa Tau, Pi Kappa Alpha, Pi Kappa Phi, Sigma Alpha Epsilon, Sigma Alpha Mu, Sigma Chi, Sigma Nu, Sigma Phi Epsilon, Sigma Pi, Tau Kappa Epsilon, Theta Chi, and Theta Tau.

NCSU has ten national general college sororities. They are Alpha Delta Pi, Alpha Kappa Alpha, Alpha Phi, Chi Omega, Delta Sigma Theta, Delta Zeta, Sigma Gamma Rho, Sigma Kappa, Zeta Phi Beta, and Zeta Tau Alpha.

Many fraternities and sororities offer housing opportunities as an additional benefit of membership.

Other Organizations. There are over 250 other student organizations. Students interested in these organizations, or in creating a new organization, may contact the Department of Student Development, Box 7314, Harris Hall, (919) 515-2441.

STUDENT MEDIA

NCSU students have the opportunity to edit and manage a variety of student-oriented media. By working with these media a student may gain valuable extracurricular experience in journalism, broadcasting, production and design, leadership, and management.

There are four media staffed by students and supported in large part by a designated portion of each student's non academic fees.

The **Agromeck**, the University yearbook, provides a record in words and pictures of student and campus activities during the past year.

The **Technician**, the student newspaper, is published three mornings a week.

The **Windhover**, the campus literary magazine, is published each spring.

WKNC (88.1-FM), the student radio station, operates at 3000 watts, enabling it to be heard within a 42 mile radius of Raleigh. The station operates 24 hours a day with a full staff of engineers, disc jockeys, and news personnel.

Several of the colleges have their own publications dealing with material of special interest to students in these areas. The publications include Agriculture and Life Sciences' *Agri-Life*; Forest Resources' *Pi Ne-Tum*; Engineering's *The Southern Engineer*; Textiles' *The Textile Forum*; Design's *The Publications of the School of Design*; and Physical and Mathematical Sciences' *The Scientist*.

MUSICAL ORGANIZATIONS

Since the early days of NCSU, musical organizations have played an important part in campus life presenting concerts, furnishing music for official University functions and performing at athletic events. The combined membership of these organizations constitutes the largest voluntary student organization on campus. Students may join the bands, choral organizations, orchestras, and pipes and drums by reporting for an audition at the time and location indicated in the orientation schedule. Rehearsals are arranged to avoid conflicts with other classes or with study time. Membership in all musical organizations is open to any regularly enrolled student.

Bands. The Symphonic Band, the Concert Band, the British Brass Band, and the Marching Band make up the four divisions of the NCSU bands. Each band serves a specific purpose and assignments are made according to individual interests and abilities. The Symphonic, Concert, and Brass Bands are concert organizations. The Marching Band is active only during football season.

Choral Groups. The Varsity Men's Glee Club, the University Choir, the Chamber Music Singers, the New Horizons Choir, and the University Community Chorus make up the five choral divisions. Placement in an organization is made according to the student's abilities and interest.

Orchestras. Members of the Raleigh Civic Symphony and the University Civic Concert Orchestra include NCSU students and faculty, students and faculty from area colleges and universities, and community members. Placement is made according to individual ability and interest. A wide range of orchestral music is read and performed, with concerts given on and off campus. Provisions are made for those with an interest in string quartet and other small ensemble experience.

NCS Pipes and Drums. Students may learn to play the bagpipes, an instrument known to many of North Carolina's early settlers, and represent the University through this unique and distinctive medium. The NCS Pipes and Drums performs several times throughout the year at University and community functions. Pipes, drums, and equipment are furnished.

Artist-in-Residence. NCSU established this special chair in the Music Department to facilitate the University's cultural development. Performing musicians are appointed to this position on a rotating basis. They are available to all University classes and organizations for concerts and presentations.

UNIVERSITY STUDENT CENTER

The University Student Center provides a focal point for much of the extracurricular life on campus featuring lounge areas, vending areas, a game room, dining facilities, meeting rooms, and much more.

The Center is guided by a student faculty Board of Directors. The Union Activities Board is the programming component of the University Student Center. Programs include lectures on a variety of topics, films, international cultural events, game tournaments, African-American cultural events, College Bowl, concerts, dances, crafts, theatre, gallery exhibits, and comedy and novelty acts. The Student Leadership Development program enables students to sharpen their skills as leaders.

Other cultural programs and opportunities provided by the Student Center include: Thompson Theatre, where students participate in acting, producing, and directing productions; the Crafts Center, where students receive instruction in a broad range of crafts; Stewart Theatre with its professional performing arts season of music, dance, and theatre; and the Visual Arts Center which maintains the University's permanent art collection.

The University Student Center Annex is located one block west of the University Student Center. Several student organizations are housed there, including Student Government, The *Technician*, *Agomeck*, *Windhover*, WKNC FM radio station, and the African American Cultural Center. A 500 seat Cinema/Lecture Auditorium is on the first floor of the Annex.

THOMPSON THEATRE

Thompson Theatre is a student oriented theatre with an emphasis on flexibility and experimentation. Each production is open to all NCSU students, whether experienced or not, as actors, technicians, crew members, and directors.

Major productions are directed and produced by the professional theatre staff. Experimental studio theatre productions are completely produced by students under the guidance and supervision of the professional staff. Opportunities also exist for involvement in African-American and children's theatre productions.

Thompson Theatre works closely with the Department of Communication which offers several courses for students interested in theatre.

University Players, Black Repertory Theatre, and Alpha Psi Omega are student theatre organizations open to all students.

CENTER STAGE/STEWART THEATRE

Center Stage presents 35 or more professional performing arts events, each year, in Stewart Theatre. Performances include jazz, modern dance, drama, experimental theatre, and folk and chamber music. Stewart Theatre is also the home to many campus sponsored activities. Special rates are available to NCSU students, faculty, and staff.

CRAFTS CENTER

Located on the ground floor of the Thompson building is one of the finest crafts facilities on any university campus. Instruction is offered in pottery, woodworking, photography, weaving, and about 30 other crafts. The facilities are also available for independent work. The Crafts Center is open year-round. Supplies for most crafts can be purchased at the center. General Ceramics (TED 351) is offered for credit through the Department of Technological Education.

VISUAL ARTS PROGRAMS/CENTER

The Visual Arts Programs Office, located on the third floor of the University Student Center, manages the Visual Arts Center and the University's permanent arts collection. The collection includes textiles, ceramics, furniture, architectural renderings, photographs, and a wide variety of works by regional and national artists in traditional fields.

The Visual Arts Center, located on the second floor of the Student Center, houses two galleries and is a public access space designed to exhibit and preserve objects of the University's permanent collection as well as special exhibits loaned to the University. Exhibits throughout the year are free and open to the public.

LEADERSHIP TRAINING

The **Student Leadership Center**, sponsored by the University Student Center, offers a variety of programs such as the Leadership Development Series and the Role Model Leader's Forum that are designed to give all NCSU students the opportunity to explore the nature of leadership and to develop their leadership potential and skills in living. The Leadership Development Series consists of approximately 50 non-credit three-hour modules that focus on different aspects of leadership. These modules are normally offered on Monday and Tuesday evenings and at least once each semester. Further information may be obtained from 3111 University Student Center, (919) 515 2452.

A **Leader's Reaction Course** is maintained and operated by the Military Science Department. This course is designed to provide practical experience in problem-solving, decision-making, and directing the activities of small groups. The course is available to all student organizations and activities officially recognized by the University. Its use must be coordinated through the Professor of Military Science.

The **Pershing Rifles** is a student organization open to all students at NCSU. Members of the Pershing Rifles participate in drill and ceremony activities to include the colorguard at home football and basketball games. Additionally, they participate in parades in the local area and regional drill meets. The Pershing Rifles is sponsored by the Army ROTC, though participants are not required to be enrolled in the ROTC program.

The **Ranger Challenge Team** is a cadet organization open to members of the Wolfpack Battalion. Members of the Ranger Challenge Team participate in many physically and mentally demanding activities throughout the school year, including tactical exercises, rope bridging, road marching, land navigation, helicopter flights, and competitions. The Ranger Challenge Team is sponsored by Army ROTC.

INTERCOLLEGIATE ATHLETICS

The Department of Athletics conducts the University's intercollegiate athletics program involving 11 varsity sports for men, nine for women, and one co-ed.

The athletics program is administered by the Athletics Director with the Athletics Council, made up of 11 faculty, three alumni, two members of student government, two student athletes, and one coach, serving in an advisory capacity to the Athletics Director and Chancellor. The program is self-supporting and is operated through gate receipts, radio and television revenues, and student fees. Funds for athletics grants-in-aid are provided through the North Carolina State Student Aid Association (Wolfpack Club). Grants-in-aid are based upon the recommendation of the coach of each sport, approved by the Athletics Director, and awarded by the University's Financial Aid Office.

Men's varsity sports include soccer, cross country, and football in the fall; basketball, swimming, indoor track, and wrestling in the winter; and track, golf, tennis, and baseball in the spring. Varsity sports for women are soccer, cross country, and volleyball in the fall; basketball, indoor track, swimming, and gymnastics in the winter; and track and tennis in the spring. During the winter the co-ed rifle team competes.

The University facilities include Carter Finley Stadium (45,600 seats); Reynolds Coliseum (12,400 seats for basketball); Doak Field (3,800 seats for baseball); the Paul H. Derr Track Stadium (3,000 seats) with a nine-lane tartan track; a 2,200 seat swimming stadium with a 25-yard by 25 meter pool and a 50-meter training and competition pool; a soccer field (5,000 seats); and a 12-court all-weather tennis complex. In addition, the Wolfpack athletics administrative offices, women's intercollegiate coaches' offices, several men's sports coaches' offices, and an athletics dining hall are housed in the Case Athletics Center. The Weisiger Brown General Athletics Facility houses the football, track, and wrestling coaches' offices, a weight room, a wrestling room, a training room, an equipment room, and dressing rooms for football, wrestling, and track. Reynolds Coliseum has a weight room, training room, and locker and dressing facilities for the women's sports and dressing rooms for the men's sports of basketball, baseball, soccer, and tennis.

INTRAMURAL-RECREATIONAL SPORTS

NCSU maintains an extensive program of intramural-recreational sports administered by the Department of Physical Education. This program is composed of divisions in intramurals, club sports, informal recreation/fitness, extramural sports, and special events. These activities are available to all students, faculty, and staff.

There are seventeen sports offered through intramurals and they include basketball, flag football, softball, soccer, volleyball, badminton, bowling, cross-country, golf, handball, pitch & putt, racquetball, squash, swim meet, table tennis, tennis, and track meet. There are 26 club sports with 10 seeking affiliation. The club sports are angling, archery, baseball, bowling, cricket, ice hockey, judo, lacrosse (men), lacrosse (women), outing, racquetball, rodeo, rowing, rugby, sailing, snow ski, soccer (men), soccer (women), squash, tae kwon do, tennis, volleyball, water polo, water ski, windsurfing, and wrestling. Those seeking affiliation are aikido, alternative sports, equestrian, fencing, field hockey, golf, mountain biking, scuba, triathlon, and weight lifting. Some of the activities included in informal recreation are broom ball, croquet, 5K fun run, free throw/hot shot contest, home run derby, inner tube water polo, pickleball, putting contest, Schick Super Hoops, frisbee, wallyball, and wiffleball. Fitness activities include a variety of aerobic sessions, such as aqua aerobics, fit pack, and (WSR) walking, swimming, and running. Additionally, there are fitness workshops in the areas of back care, nutrition, flexibility, relaxation, training techniques, and weight lifting. Extramural sports events include participation in "Big Four Sports Day", a competition between Duke, NCSU, UNC-Chapel Hill, and Wake Forest. Students also participate in the National Invitational Flag Football Championship.

The Intramural-Recreational Sports Program is comprehensive in scope and committed to meeting the sports and physical activity needs of the students, faculty, and staff at NCSU.



COLLEGES, DEPARTMENTS, AND PROGRAMS OF STUDY

Undergraduate programs of study are offered by the College of Agriculture and Life Sciences, the School of Design, the College of Education and Psychology, the College of Engineering, the College of Forest Resources, the College of Humanities and Social Sciences, the College of Management, the College of Physical and Mathematical Sciences, and the College of Textiles.

GENERAL EDUCATION DISTRIBUTION REQUIREMENTS

A university education should prepare students for a full life in their professions and occupations by means of curricula that provide both practical foundations for future careers and such intangibles as intellectual flexibility, broad knowledge, and a basic comprehension of human achievements. To accomplish these ends, all baccalaureate programs at NCSU include the following general education requirements:

English Composition Satisfactory completion of ENG 111 and ENG 112.

Mathematics Six credit hours of mathematics and or work in the closely related fields of statistics, computer science, and logic. At least one of these courses must be a course in mathematics.

Humanities and Social Sciences Eighteen credit hours not including ENG 111 and ENG 112. Within the minimum of eighteen credit hours, at least six credit hours must be in the humanities and at least six credit hours must be in the social sciences. A list of courses appropriate for use as humanities courses and a list of courses appropriate for use as social science courses are issued periodically by the Provost's Office. Courses not on the list may not be used to fulfill humanities or social science requirements in any curriculum. Colleges and departments may specify groups of courses or specific individual courses from the list to be used by their students in fulfilling the humanities and social science requirements in their curricula.

Natural Sciences Eight credit hours, including at least one basic course from the biological, earth, or physical sciences.

Free Electives All curricula must include at least nine credit hours of free electives. No other limitations should be imposed upon the student's choice of these electives, provided the student has satisfied the prerequisites and provided that no elected course should cover material that is considered remedial, that covers material at an elementary level after the student has taken comparable material at an advanced level, or that covers material substantially presented in a course previously taken. Students are encouraged to use their free electives to explore fields of study different from those required in their curriculum. Free electives may be taken on a credit-only basis up to a maximum of 12 credit hours. Types of courses that are frequently selected as free electives include environmental awareness courses, fine arts, introductions to a

discipline or technology designed for non-majors, additional humanities and social sciences, and courses that are part of a minor, a second major, or a dual degree. Any elective in a curriculum is interpreted as a free elective unless qualifications are specifically listed.

Physical Education Four credit hours of physical education (PE 100 and three credit hours of activity courses). Required physical education courses may be taken on a credit-only basis. Students with appropriate skills, experience, and knowledge may satisfy three of the four required physical education credits (PE 100 not included) through credit by examination. All students who do not pass the survival swimming test taken during PE 100 will be expected to take PE 112 (Beginning Swimming) unless exempted.

The full requirements for completion of each undergraduate program of study at NCSU reflect the general education distribution requirements described above, additional college requirements, and departmental requirements particular to a given major or degree program. Throughout this section the degree requirements are frequently shown as particular courses or categories of courses. The **course prefix abbreviations** (e.g., ANS, CSC, HI, and PSY) provide a key for locating the basic information for individual courses in the "Course Descriptions" section of this catalog.

FUTURE GENERAL EDUCATION DISTRIBUTION REQUIREMENTS

The Council on Undergraduate Education has recommended and the University Academic Policy Council has approved a major revision in NCSU's general education requirements for all baccalaureate degrees. These new requirements are intended to be incorporated into each undergraduate curriculum for new freshman and transfer students entering in the summer and fall of 1994.

The revised general education requirements are designed to achieve the following goals:

- (1) help students to use the arts of communication as powerful modes of learning, as ways of understanding the thought and conventions of the disciplines and professions, and as ways of participating effectively in those disciplines and professions as well as in social and civic life.
- (2) introduce students to the principles and methods of the natural and mathematical sciences.
- (3) introduce students to a broad range of ideas, modes of inquiry, and pivotal works in the humanities and social sciences.
- (4) help students to develop an appreciation of diverse cultures and traditions throughout the world, and
- (5) help students to understand the interactive nature of science, technology, and society as well as the dilemmas posed by such interactions.

MATHEMATICAL AND NATURAL SCIENCES

Mathematical Sciences—Rationale

The study of mathematical sciences will enable the student to:

- (1) understand rudimentary mathematics so as to function intelligently in our technological society,
- (2) appreciate mathematics as a human endeavor and as a deductive discipline,
- (3) develop problem-solving skills applicable to a variety of decision-making situations, and
- (4) become a more critical consumer of quantitative information.

Natural Sciences—Rationale

Development and application of new technologies at an increasing rate, which frequently have an impact on seemingly unrelated areas, require scientifically literate citizens capable of understanding the issues, contributing to both the debate and, ultimately, to the choice between alternative actions. The natural sciences component of general education should strive to develop an adequate level of scientific literacy in all students to provide them with the skills to be participatory citizens in an increasingly technological society.

Education in the natural sciences will enable the student to:

- (1) develop knowledge of the major concepts, principles, laws, theories, and responsible applications of science,
- (2) understand the methods and processes of science in solving problems and making decisions,
- (3) understand the interactions of science, technology and society, and
- (4) cultivate interests that will lead to a richer and more satisfying life through a continuing awareness of scientific developments.

Minimum requirements for all curricula (20 hours)

A total of six courses (20 hours) in the mathematical and natural sciences.

- (1) Two courses (6 hours) selected from mathematics, statistics, and logic; one must be a mathematics course.
- (2) Three courses (11 hours) from the natural sciences: two from different basic sciences (biology, chemistry, earth sciences and physics); two of the three courses must have a laboratory.
- (3) The sixth course (3 hours) selected from any of the mathematical science; natural science; or science, technology and society courses.

WRITING AND SPEAKING

Rationale

Writing and speaking are powerful ways of understanding ourselves and the world we live in. It is through writing and speaking that the various disciplines and professions define the knowledge and methodologies that characterize them. Because these communication arts are central to learning and to engaging in the productive life of a community, students must:

- (1) learn to use writing and speaking as ways of generating, critiquing, and refining ideas, both their own and those of others;
- (2) understand and use the conventions and standards governing written and spoken discourse across academic disciplines;
- (3) develop the critical reading, writing, and speaking abilities necessary for participating effectively in a discipline; and
- (4) develop a repertoire of strategies for addressing the concerns of audiences in the many contexts of contemporary life - academic, professional, and civic.

Minimum requirement for all curricula (9 hours)

- (1) Two semesters of composition and rhetoric during the freshman year.
- (2) One semester from any of the following:
 - (a) advanced writing,
 - (b) speech, or
 - (c) foreign language (FL 201 or higher in the student's first foreign language or any FL course in a second language).

Meeting these goals requires students to engage in writing and speaking across the curriculum. To this end, communications requirements should be integral to all courses used by students to fulfill the humanities and social sciences requirements.

Further, in order that skills develop broadly and consistently along with the individual's increasing knowledge of subject matter, all upper-division courses offered in the University should incorporate a significant communications requirement, and at least one major written paper should be required in every curriculum in both the junior and senior years.

FOREIGN LANGUAGE

Rationale

In a sense, languages are keys to the world. The continuous expansion of international relations makes the knowledge of foreign languages increasingly significant. In learning a foreign language and studying its literature and cultures, students acquire a body of knowledge about how humans think, view the world, express themselves, and communicate with one another.

Language learning also expands one's ability to create and discover new meaning in one's own language and culture. Knowledge of the linguistic structures of a second language helps students to understand their own language better. Likewise, an awareness of contrasting cultural concepts sensitizes students to the differences between their own culture and others. Such an awareness has become increasingly important as the communities of the world have become more interconnected and interdependent. The needs of our global society require that more citizens have access to other languages and cultures in order to cooperate in the process of improving the quality of human life.

Minimum requirements for all curricula (0 hours)

- (1) Two years of high school foreign language be required as a prerequisite for admission to the University.

- (2) Foreign language proficiency at the FL 102 level be required for graduation.

HUMANITIES AND SOCIAL SCIENCES

Rationale

The subject of the humanities and social sciences is the human condition in its many manifestations. Studying these disciplines enables us to understand what is common to humanity as a whole and to appreciate differences among groups and individuals. Our capacity to function in society and to contribute meaningfully to it is enhanced by the awareness of human values and choices, and by the understanding of human processes, that an education in the humanities and social sciences develops. Such an education also empowers people to have well-considered moral convictions, intellectual preferences, and tastes; to make their own and others' lives more fully human by drawing on a wide range of cultural resources; and to participate in public life as informed and responsible citizens.

The goal of education in the humanities and social sciences is to give the students adequate understanding of:

- (1) the cultural and linguistic traditions of their own and other societies,
- (2) the present as a product of historical processes,
- (3) the application of theoretical and quantitative models to the study of human behavior, both individual and collective,
- (4) ethical choices and the issues of human values they entail, and how to make those choices with intellectual rigor and clarity,
- (5) the aesthetic, personal, and cultural significance of works of art,
- (6) various disciplines as modes of inquiry with distinctive purposes and intellectual processes, and
- (7) their majors in a broader context that incorporates social, historical, ethical and aesthetic perspectives,

and the ability to:

- (1) distinguish degrees of plausibility and verification, by critically examining both evidence and logic,
- (2) read analytically (i.e. to reconstruct arguments and consider implications) and interpretatively (i.e. to grasp meaning by being sensitive to the ways in which meaning is generated), as well as to acquire information, and
- (3) recognize patterns within and between content areas.

Minimum requirements for all curricula (21 hours)

The general education requirements in the Humanities and Social Sciences consist of 21 hours designed to expose students to content areas that demonstrate the relevant modes of inquiry:

- (1) Two courses or the equivalent in the study of history and or literature (6 hours).

The study of history provides an understanding of continuities and changes in human thought and behavior and of the ongoing process in which individuals shape and are shaped by their societies and their governments.

Studying history also provides training in the analysis of process and the evaluation of a wide variety of evidence.

The study of literature introduces students to the many ways of deriving meaning from the human condition and to the many forms in which meaning is expressed. Studying literature also develops students' capacity for critical analysis and personal expression, their aesthetic sensitivity, and their reading and writing skills.

- (2) One course or the equivalent in the study of philosophy, religion, or the visual and performing arts (3 hours).

In the study of philosophy, students are exposed to the rigorous procedures of philosophical thought, to ethical issues, and to the insights of ethical reasoning. In the study of religions, they are introduced to beliefs of their own and other cultures, and they learn how various religions have resolved ethical issues and have addressed the human condition. The visual and performing arts develop students' aesthetic sensitivities, critical judgment, and personal creativity. They also provide students with an understanding of the cultural and historical dimensions of artistic expression.

- (3) Two courses or the equivalent from different content areas, in the study of psychology, economics, politics and government, sociology, anthropology and cultural geography. (6 hours).

The study of these subjects enables students to understand individual and collective human behavior by exploring meaning within a variety of social, cultural and political contexts; by analyzing the structures within which human goals are established and human choices are made; and by applying theoretical and quantitative models to specific cases.

- (4) Two additional courses selected within Humanities and Social Sciences (6 hours).

These hours could be used to pursue specific interests, to provide additional breadth or develop depth by taking courses focused on a common theme.

- (5) Among the courses selected to fulfill the Humanities and Social Sciences requirement at least one must focus on a non-English speaking culture.

PHYSICAL EDUCATION

Rationale

Essential to a university student's development are attitudes and skills for healthy life styles. In addition to maintaining fitness, participation in team and individual physical activity significantly reduces major health risks.

Goals for students in physical education include:

- (1) learning the fundamentals of cardiovascular and strength development and applying this knowledge in the initiation and/or continuation of personal fitness programs,
- (2) acquiring the basic skills of several lifetime sports or activities and enhancing their proficiencies in these skills so that they will continue to participate throughout life,
- (3) gaining a working knowledge of the rules, strategies, and safety aspects of several sports or activities,
- (4) reducing stress from the academic rigors of their other courses, and

- (5) improving their general physical, social, and mental well-being while learning, participating, and having fun.

Minimum requirements for all curricula (2 hours)

Two credit hours, four semesters in physical education.

- (1) This requirement includes PE 100.
- (2) All courses will be available on an S U basis.

SCIENCE, TECHNOLOGY AND SOCIETY

Rationale

North Carolina State University, as a land grant university, has a mission that stresses the application of science and technology or the betterment of humankind. It is essential, therefore, that students be exposed to the vital interactions among science, technology, society and the quality of life.

Goals for students completing the Science, Technology and Society requirement include:

- (1) developing an understanding of the influence of science and technology on civilizations,
- (2) developing the ability to respond critically to technological issues in civic affairs, and
- (3) understanding the interactions among science, technology and values.

Minimum requirement for all curricula (3 hours)

Courses which satisfy this requirement can be oriented toward science and technology or toward the humanities and social sciences. This course can also partially satisfy either the humanities and social sciences requirement or the mathematical and natural sciences requirement but not both. Students with majors in science and technology should study this topic from a humanities and social sciences perspective and those students in the humanities and social sciences should select courses oriented toward science and technology. This requirement can be satisfied by an interdisciplinary course designed to cover both perspectives.

COMMUNICATION AND INFORMATION TECHNOLOGY

Computer Literacy—Rationale

Today's graduate must have a knowledge of information technology and computer applications. Every student needs a basic understanding of information processing. It is not necessary that every student be a programmer.

Students should develop and demonstrate proficiency in the use of computers, learning to use applications such as word processing, spreadsheets, database management programs, electronic mail, and packages and applications specific to their field of study.

Minimum requirement for all curricula (0 hours)

The following may be used to fulfill computer technology instruction:

- (1) instruction and assignments required within courses, and/or
- (2) required use of a computer to complete assignments.

Library/Information Literacy—Rationale

The demands of an increasingly technological and information-dependent society require that students have a basic understanding of how information is identified and defined by experts, structured, physically organized, and accessed.

Proficiency is best gained by requiring the use of information resources to complete an assignment or to create a bibliography from which a paper or speech is developed. Information retrieval instruction beyond that provided in freshman English could be connected with writing and speaking requirements and or it could be taught by requiring assignments involving substantial use of library resources. Academic units are encouraged to work closely with library staff for the development and delivery of instruction and experience in information retrieval techniques.

Minimum requirement for all curricula (0 hours)

The following may be used to fulfill information retrieval instruction:

- (1) use of one or more class periods to teach the structure of information, and to provide experience using major information resources.
- (2) use of self-paced printed instructional materials.
- (3) use of computer based instructional materials.
- (4) development of an information based assignment requiring use of library resources, and or
- (5) other methods as appropriate for the discipline.

FREE ELECTIVES

All schools and colleges are encouraged to include free electives in their curricula to satisfy their educational objectives. Moreover, students who would like to take courses beyond those required for their degree are encouraged to do so.

TOTAL HOURS

Minimum credit hours required in an baccalaureate curriculum that has not been designated a five year program range from 120 to 128.

GRADUATION REQUIREMENTS

Students are eligible for graduation when they have completed satisfactorily all the academic requirements of their degree program as specified by their major department, their college, and the University.

NCSU requires that, in addition to other University, college, and departmental requirements, all students must have a grade point average of at least 2.0, based

on all courses attempted at NCSU, in order to be eligible to receive a baccalaureate degree.

Minimum Hours Required for Graduation These are shown for each curriculum and range from 120 to 141. Curricula in the high range normally are those involving a required summer camp or field experience. Students may take more hours than the required minimum.

Length of Time to Graduation The normal and expected length of time to graduation is four years (eight semesters) which requires a student to complete an average of slightly more than 16 credit hours each semester (for most curricula) or to attend one or more summer sessions.

In order to make continuous progress toward graduation, students are encouraged to take full advantage of the University's advising and support services. Effective career decision-making and early, deliberate, long-range semester-by-semester planning of courses and careful selection of extra-curricular commitments can provide direction and motivation necessary for effective use of time to graduation. Additional factors that may assure a student's continuous progress toward graduation include (1) good academic performance in freshman and basic prerequisite courses, (2) advanced placement credit for introductory courses, and (3) enrollment in summer sessions.

Students are discouraged from taking unrealistic course loads as a means to accelerate their progress toward graduation as this may result in poor academic performance.

Students may take more than eight semesters to complete an undergraduate program at NCSU. In some cases this is the result of effective decision making on the part of the student for such things as (1) participation in cooperative education or study abroad programs, (2) a decision to be a part time student with a reduced course load for reasons of health, necessary outside employment, or parental responsibilities, or (3) attempting dual degrees, double majors, or academic minors. In other cases the length of time to graduation may be prolonged beyond the eighth semester as a result of (4) incomplete or inadequate secondary school background requiring some additional compensatory, developmental, or prerequisite courses, (5) poor academic performance in the freshman year or early semesters, or (6) late changes of curriculum.

Semester-by-Semester Displays—The requirements for many curricula throughout this section are set forth in semester-by-semester displays. One purpose for these displays is to illustrate how certain sequences of courses and prerequisites may be scheduled. Another purpose is to reflect whether courses are normally offered in the fall or the spring semester. Otherwise, the semester-by-semester displays are merely advisory and not mandatory. The typical semester schedule shown in the displays may not be the appropriate one for many students. Students are required to consult with their faculty advisers prior to registration each semester.

Limited D Grades Some colleges and departments have established limitations on the use of D grades in certain courses or categories of courses for satisfying graduation requirements.

Grade Point Average in Major Some departments have established graduation requirements of a grade point average of 2.0 on all courses attempted in

the major at NCSU or a "C" or better in some or all major courses. Such a requirement is in addition to the University grade point average requirement of 2.0 for all courses attempted at NCSU. Students are encouraged to inquire about specific requirements in majors of interest.

Residence Requirements—To be eligible for a bachelor's degree, a student must be enrolled in a degree program and must have earned at least 30 of his or her last 45 hours of credit through NCSU courses. Individual departments and/or colleges may have additional residence requirements.

Note: The College of Engineering has a policy that transfer students normally must earn at least 48 of their last 60 hours of credit at NCSU while enrolled as degree candidates.

MINORS

Some departments at NCSU offer undergraduate minors for students wishing a systematic program of study in an area outside their major. All minors require at least 15 credit hours and may be either departmental or interdepartmental. Courses within the minor program may be used to satisfy any of the general requirements, including free electives, of a major curriculum. Minors are completely optional, the only requirement being that a student may not minor in the same discipline as their major. Students pursuing a minor must consult with a minor adviser on a plan of work and must file a copy of this plan with their major adviser at least one semester before graduation. Satisfactory completion of the minor will be noted on the final transcript following graduation. (See "Academic Fields of Study and Degrees" in this catalog for a listing of available minors.)

TWO DEGREES

Students who have satisfactorily completed the requirements for more than one bachelor's degree may, upon the recommendation of their deans, be awarded two bachelor's degrees at the same or at different commencement exercises. To earn two degrees students register in one school or department and, with the cooperation of the second school or department, work out their program to cover the requirements for both. Students must file an approved Double Majors Only Curriculum Change Form with Registration and Records, 1000 Harris Hall. An Application for Degree Form must be submitted for each degree.

TRANSCRIPTS OF ACADEMIC RECORD

A transcript is an exact copy of a student's permanent academic record at the time it is issued. A fee of two dollars is charged for each transcript.

No official transcript may be issued to or for a student who is indebted to the University until such indebtedness has been paid or satisfactorily adjusted.

Official transcripts are issued only upon the written request of the student to Registration and Records, Box 7313, NCSU, Raleigh, North Carolina 27695-7313.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Patterson Hall (Room 115)

D. F. Bateman *Dean*

J. L. Oblinger, *Associate Dean and Director of Academic Programs*

W. C. Grant, *Assistant Director of Academic Programs*

K. L. Esbenschade, *Assistant Director of Academic Programs and Director of Agricultural Institute*

M. C. Bullock, *Coordinator of Career Development and Placement Office*

The academic programs in the college represent a unique blending of the agricultural and life sciences. Agriculture is a very diverse industry that touches everyone's life in some way or another. The life sciences provide foundations for studying medical and health-related disciplines as well as environmental sciences and molecular biology.

The goals of the instructional program in the College of Agriculture and Life Sciences include providing relevant, scientific, and practical knowledge of the food, agricultural, and life sciences to its students. These programs emanate from a highly qualified and accomplished faculty committed to academic excellence and the development of the individual to his or her personal and professional potential. Central to the college's goals is the cultivation of interdisciplinary problem-solving skills which will serve its graduates well as they pursue a lifetime of learning and adaptation to change.

The overall objectives of the academic program include the following:

- 1) To provide an opportunity for a broad university education
- 2) To provide a variety of learning experiences
- 3) To offer a choice of specialization in agriculture and life sciences
- 4) To provide background for graduate or professional programs

STUDENT ACTIVITIES

Students in the College of Agriculture and Life Sciences have numerous opportunities to take part in broadening extracurricular activities. Most departments have student organizations that provide professional as well as social experience. Representatives of these clubs form the Agri Life Council. This council is the student organization representing the College. Student tours provide an opportunity to see firsthand the application of classroom principles. In addition, students representing agrimarketing, agronomy, animal science, horticultural science, food science, poultry science and soil science compete regionally and nationally in a number of activities providing student members a chance to learn by travel as well as by participation.

CURRICULUM OFFERINGS AND REQUIREMENTS

A freshman enrolling in Agriculture and Life Sciences has common core courses the first year courses appropriate in all curricula. This approach allows the student time to explore various programs before selecting a curriculum. The student selects a major in a department or interdisciplinary program. All departments offer science curricula (intended primarily for students who anticipate attending graduate or professional school); several technology curricula; and the Agricultural Business Management curriculum is offered in the Department of Agricultural and Resource Economics.

Departmental majors are offered as follows:

Science—agricultural economics, animal science, applied sociology, biochemistry, biological and agricultural engineering (joint program with the College of Engineering), botany, fisheries and wildlife sciences (joint program with the College of Forest Resources), food science, horticultural science, medical technology, microbiology, poultry science, and zoology. Preprofessional courses are offered in the science curriculum track.

Technology—agricultural systems technology, animal science, food science, horticultural science and poultry science.

Business—agricultural business management is offered through the Department of Agricultural and Resource Economics. A concentration in biological sciences and the opportunity for double majoring in business and other programs are available.

Interdepartmental and Interdisciplinary Programs—These curricula offer the opportunity to select broad curriculum majors that involve two or more departments or colleges:

Agronomy—A technical curriculum dealing with the fundamentals of crop production and soil management. The curriculum is administered by the Departments of Crop Science and Soil Science.

Biological Sciences—A curriculum with emphasis on biological and physical sciences, especially designed for graduate or professional courses requiring a biology background.

Natural Resources—A curriculum concentrating on the use, management and improvement of natural resources. The curriculum is administered jointly by the College of Agriculture and Life Sciences, the College of Forest Resources and the College of Physical and Mathematical Sciences.

In addition to these cited curricula, a number of arrangements are available that provide the student an opportunity to select areas of course concentration.

ACADEMIC MINORS

Several departments in the College of Agriculture and Life Sciences offer a minor in their discipline. Students interested in additional information regarding a minor should contact the appropriate departmental office. At present, the following minors are available:

Agricultural Business Management	Food Science
Agricultural Economics	Genetics
Agricultural Systems Technology	Horticultural Science
Animal Science	Microbiology
Applied Sociology	Nutrition
Biological Sciences	Soil Science
Botany	Zoology
Entomology	

HONORS PROGRAM

The College of Agriculture and Life Sciences has a comprehensive honors program for qualified students throughout their academic career. Both seminar discussion programs covering broad topics and an independent research program are included. Faculty provide direction on an individual basis to each student with the student selecting his or her project.

Participation in CALS Honors Program is limited to CALS students with a GPA of 3.25 or above. The following ALS courses, 299H, 498H, 499H, are required. In addition, a student must take at least six hours of honors coursework (at least 3 credits outside CALS) or participate in the University Scholars Program for at least two semesters. Honors coursework must be completed with a "C" or better.

HONORS SOCIETIES

Students in all majors with strong academic records are recognized by national organizations that have local chapters, Gamma Sigma Delta, Alpha Zeta, Alpha Epsilon Delta and Phi Kappa Phi.

SCHOLARSHIP PROGRAM

The College of Agriculture and Life Sciences awards approximately 300 scholarships each year on a combination of selection factors including merit, financial need and leadership.

JEFFERSON SCHOLARS IN AGRICULTURE/LIFE SCIENCES AND THE HUMANITIES

(See also College of Humanities and Social Sciences)

The Thomas Jefferson Scholars Program in Agriculture Life Sciences and the Humanities is a joint program of the College of Agriculture and Life Sciences and the College of Humanities and Social Sciences. It is a double degree which permits participants to have two concentrations: one in an area of agriculture life sciences and one in an area of humanities social sciences. The double degree program may be individually designed to meet each student's particular interests and career goals. The purpose of the program is to produce potential leaders in agriculture and the life sciences who have not only technical expertise but also an appreciation for the social, political, and cultural issues that affect decision-making.

Each spring a number of entering freshmen are chosen to receive scholarships to participate in the Jefferson program. In addition, other qualified students may choose to pursue a double major in agriculture life sciences and the humanities under the Jefferson program.

Students interested in applying to the Jefferson Scholars program should contact: Dr. James L. Oblinger, Associate Dean, College of Agriculture and Life Sciences, Box 7642, North Carolina State University, Raleigh, NC 27695 (515 2615) or Dr. Mary L. Walek, Assistant Dean, College of Humanities and Social Sciences, Box 8101, North Carolina State University, Raleigh, NC 27695 (515 2467), before January 15.

INTERNATIONAL STUDIES

An international seminar is offered to interested students. In addition, an international option, requiring a modern foreign language and 12 semester hours of appropriate courses in the social sciences, is available for students enrolled in any curricula.

DEGREES

The Bachelor of Science degree is conferred upon the satisfactory completion of one of the curricula in this college.

The degrees of Master of Science, Master of Agriculture and Master of Life Sciences are offered in the various departments in the college.

The Doctor of Philosophy degree is offered in the following subject areas: animal science, biochemistry, biological and agricultural engineering, botany, crop science, economics, entomology, food science, genetics, horticultural science, microbiology, nutrition, physiology, plant pathology, sociology, soil science, toxicology, and zoology.

Further information on graduate offerings may be found in the *Graduate Catalog*.

CAREER OPPORTUNITIES

A diversity of careers are available in agriculture and the life sciences. Areas pursued by graduates includes:

Professional and Graduate Education The college provides preprofessional programs at the undergraduate level for medical, dental, optometry, pharmacy and veterinary medicine. Many of our graduates pursue advanced degrees including a Masters or Doctor of Philosophy in a variety of disciplines.

Research Medical; biological; agricultural; environment; processing; economics; marketing.

Agricultural, Horticultural Production Livestock; poultry; aquaculture; fruits; vegetables; ornamentals; turfgrass.

Business and Industry Banking; real estate farm appraising; technical sales; farm management; marketing; retail management; manufacturing; processing.

Environmental/Natural Resources Soil, water, forest, fish and wildlife, and education.
Education/Government High school and college instruction in agriculture and life sciences; extension agents; research associates.

Services—Inspection and regulation; environmental testing; product grading; consulting.

The College has a Career Development and Placement Office, located in 111 Patterson Hall. For additional information, contact the Coordinator, Marcy Bullock, 515-3249.

FRESHMAN YEAR

The curricula in the College of Agriculture and Life Sciences have a common freshman year with the exception of the science program in biological and agricultural engineering. For the freshman year of that curriculum, see the College of Engineering.

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ALS 103 Introductory Topics in ALS	1	BS 100 General Biology or	
BS 100 General Biology or		CH 101 General Chemistry I and	
CH 101 General Chemistry and		CH 121 General Chemistry I Laboratory or	
CH 121 General Chemistry Laboratory ³	4	CH 107 Principles of Chemistry and	
ENG 111 Composition and Rhetoric	3	CH 127 Principles of Chemistry Laboratory	4
MA 111 Precalculus Algebra & Trig ²	3	ENG 112 Composition and Reading	3
PE 100 Health & Physical Fitness	1	MA 114 Intro. to Finite Math. with Appl. or	
Humanities/Soc. Sci. Elective	3	MA 131 Analytic Geometry & Calc. A	3-4
(Military Science or Air Science may be elected)		Humanities/Soc. Sci. Elective	3
		Physical Education	1
		(Military Science or Air Sciences may be elected)	
	15		14-15

¹Both biology and chemistry are required for all ALS curricula.

²Does not contribute to the total semester hours required for graduation in certain curricula. Consult departmental faculty adviser.

A B C D ELECTIVES

The following lists provide typical courses that may be selected from each of the four groups. Group A includes the physical and biological sciences; Group B, economics and business; Group C, applied science and technology; and Group D, social sciences and humanities. Other appropriate courses may be selected by checking with the Office of the Director of Academic Programs.

Group A

PHYSICAL AND BIOLOGICAL SCIENCES

Animal Science

ANS 130 Anatomy and Physiology of Domestic Animals
ANS 220 Reproduction, Lactation and Behavior of Domestic Animals
ANS 230 Genetics, Nutrition and Growth of 30 Domestic Animals
ANS 405 Lactation
ANS (NTR,PO) 415 Comparative Nutrition
ANS (NTR) 419 Human Nutrition in Health and Disease
ANS 500 Advanced Ruminant Nutrition
ANS (PHY) 502 Reproductive Physiology of Mammals
ANS (GN) 508 Genetics of Animal Improvement
ANS (NTR) 516 A,B,C,D Animal Nutrition Research Methods
ANS 540 Ruminant Physiology and Metabolism
ANS (PHY) 580 Mammalian Endocrinology

Biochemistry

BCH 150 Introductory Biochemical Concepts
BCH 451 Introductory Biochemistry
BCH 552 Introductory Biochemistry Laboratory
BCH 453 Introduction to Molecular Biology and Metabolism
BCH 540 Proteins
BCH 541 Nucleic Acids
BCH 542 Metabolism
BCH 543 Biochemical Regulatory Processes
BCH 544 Intermediary Metabolism
BCH 552 Experimental Biochemistry
BCH (GN) 561 Biochemical and Microbial Genetics

Biological and Agricultural Engineering

BAE 303 Energy Conversion in Biological Systems

Biological Sciences

All courses listed with the BS designation.

Biomathematics†

Appropriate courses

Botany

- BO 200 Plant Life
 BO 213 Plants and Civilization
 BO (ZO) 360 Introduction to Ecology
 BO (ZO) 365 Ecology Laboratory
 BO 400 Plant Diversity
 BO 403 Systematic Botany
 BO 413 Introductory Plant Anatomy
 BO (ZO) 414 Cell Biology
 BO 421 Plant Physiology
 BO 510 Plant Anatomy
 BO 522 Adv. Morphology and Phylogeny of Seed Plants
 BO 524 Grasses, Sedges and Rushes
 BO 565 Plant Community Ecology
 BO 580 Plant Molecular Biology

Chemistry†

Appropriate Courses

Computer Science†

Appropriate Courses

Entomology

- ENT 301 Introduction to Forest Insects
 ENT 312 Introduction to Economic Entomology
 ENT (ZO) 425 General Entomology
 ENT 502 Insect Diversity
 ENT 503 Functional Systems of Insects

Fisheries Wildlife†

- FW (FOR) 404 Forest Wildlife Management
 FW (ZO) 420 Fishery Science
 FW (ZO) 515 Fish Physiology

Food Science

- FS 331 Food Engineering
 FS 402 Food Chemistry
 FS 403 Food Analysis
 FS (MB) 405 Food Microbiology
 FS 504 Food Proteins and Enzymes
 FS (MB) 506 Advanced Food Microbiology
 FS 509 Food Lipids
 FS 510 Food Carbohydrates
 FS (MB) 525 Fermentation Microbiology

Forestry

- FOR (WPS) 273 Quantitative Methods in Forest Resources
 FOR (MEA) 386 Agricultural and Forest Meteorology
 FOR (FW) 404 Forest Wildlife Management

Genetics

- GN 411 Principles of Genetics
 GN 412 Elementary Genetics Laboratory
 GN 504 Human Genetics
 GN (ANS) 508 Genetics of Animal Improvement
 GN (ZO) 540 Evolution
 GN (BCH) 561 Biochemical and Microbial Genetics

Marine, Earth and Atmospheric Sciences†

Appropriate Courses

Mathematics†

Appropriate Courses

Microbiology

- MB 200 Microbiology and World Affairs
 MB 401 General Microbiology
 MB (FS) 405 Food Microbiology
 MB 411 Medical Microbiology
 MB 414 Microbial Metabolic Regulation
 MB 501 Advanced Microbiology I
 MB 502 Advanced Microbiology II
 MB 503 Microbial Diversity
 MB (FS) 506 Advanced Food Microbiology
 MB 514 Microbial Metabolic Regulation
 MB 518 Introductory Virology
 MB (FS) 525 Fermentation Microbiology
 MB (SSC) 532 Soil Microbiology
 MB 551 Immunology

Nutrition

- NTR (ANS,PO) 415 Comparative Nutrition
 NTR (ANS) 419 Human Nutrition in Health and Disease
 NTR (ANS) 516 A,B,C,D Animal Nutrition Research Methods

Physics†

Appropriate Courses

Physiology

- PHY (ANS) 502 Reproductive Physiology of Mammals
 PHY (ZO) 503 General Physiology I
 PHY (ZO) 504 General Physiology II
 PHY (ZO) 513 Comparative Physiology
 PHY (ANS) 580 Mammalian Endocrinology

Plant Pathology

- PP 501 Phytopathology I
 PP 502 Phytopathology II

Poultry Science

- PO 405 Avian Physiology
 PO (ANS,NTR) 415 Comparative Nutrition
 PO (ZO) 524 Comparative Endocrinology

Soil Science†

- SSC 200 Soil Science
 SSC 511 Soil Physics
 SSC 520 Soil and Plant Analysis
 SSC 522 Soil Chemistry
 SSC (MB) 532 Soil Microbiology
 SSC 562 Environmental Applications of Soil Science

Statistics†

Appropriate Courses

Zoology

- ZO 201 General Zoology
 ZO 205 Introduction to Cellular and Developmental Zoology
 ZO 208 Introduction to Organismal and Evolutionary Zoology
 ZO 212 Basic Anatomy and Physiology
 ZO (MEA) 220 Marine Biology
 ZO 303 Vertebrate Zoology

ZO 304 Vertebrate Zoology Laboratory
 ZO 305 Cellular and Animal Physiology Laboratory
 ZO 315 General Parasitology
 ZO (BO) 360 Introduction to Ecology
 ZO 361 Principles of Embryonic Development
 ZO (BO) 365 Ecology Laboratory
 ZO 370 Developmental Anatomy and Histology of the Vertebrates I
 ZO 371 Developmental Anatomy and Histology of the Vertebrates II
 ZO 375 Developmental Anatomy and Histology Laboratory I
 ZO 376 Developmental Anatomy and Histology Laboratory II
 ZO 402 Invertebrate Zoology
 ZO 403 Invertebrate Zoology Laboratory
 ZO 410 Introduction to Animal Behavior
 ZO (BO) 414 Cell Biology
 ZO (FW) 420 Fishery Science
 ZO 421 Principles of Physiology
 ZO 422 Biological Clocks
 ZO (ENT) 425 General Entomology
 ZO 441 Biology of Fishes
 ZO 442 Biology of Fishes Laboratory
 ZO 450 Evolutionary Biology
 ZO 460 Aquatic Natural History Laboratory
 ZO 480 Laboratory Techniques in Cellular Biology
 ZO (PHY) 503 General Physiology I
 ZO (PHY) 504 General Physiology II
 ZO (PHY) 513 Comparative Physiology
 ZO (FW) 515 Fish Physiology
 ZO 517 Population Ecology
 ZO 522 Biological Clocks
 ZO (PO) 524 Comparative Endocrinology
 ZO (GN) 540 Evolution

†Courses in these blocks are considered Physical Sciences.

Group B

ECONOMICS AND BUSINESS

Accounting

ACC 100 Introduction to Accounting
 ACC 200 Computerized Accounting Applications
 ACC 210 Accounting I: Concepts of Financial Reporting
 ACC 220 Accounting II: Introduction to Managerial Accounting
 ACC 280 Managerial Uses of Cost Data
 ACC 300 Professional Accounting Environment
 ACC 310 Intermediate Financial Accounting I
 ACC 311 Intermediate Financial Accounting II
 ACC 320 Managerial Uses of Cost Data
 ACC 330 An Introduction to Income Taxation
 ACC 408 Commercial Law for Accountants
 ACC 410 Advanced Financial Accounting
 ACC 420 Production Cost Analysis and Control
 ACC 430 Advanced Income Tax
 ACC 440 Accounting Information Systems
 ACC 450 Auditing Financial Information
 ACC 451 Advanced Auditing Topics
 ACC 460 Specialized Financial Reporting Theory and Practice

Agricultural and Resources Economics

ARE 303 Farm Management
 ARE 306 Agricultural Law
 ARE 312 Agribusiness Marketing
 ARE 321 Agricultural Financial Management
 ARE 403 Economics of Consumer Decisions

ARE 423 Futures and Options Markets
 ARE 433 U.S. Agricultural Policy

Business Management

BUS 307 Business Law I
 BUS 308 Business Law II
 BUS (EC) 310 Managerial Economics
 BUS 320 Financial Management
 BUS 330 Human Resource Management
 BUS 332 Industrial Relations
 BUS 346 International Business
 BUS (ST) 350 Economics and Business Statistics
 BUS 360 Marketing Methods
 BUS 405 Regulatory Law
 BUS 420 Financial Management of Corporations
 BUS 422 Investments and Portfolio Management
 BUS 455 Quantitative Methods for Management
 BUS 462 Marketing Research
 BUS 465 Advertising and Promotion Management
 BUS (TAM) 482 Textile Marketing Management
 BUS (WPS) 485 Management Development Seminar

Economics

EC (BUS) 310 Managerial Economics
 EC 451 Introduction to Econometrics

Mathematics

MA 105 Mathematics of Finance

Statistics

ST (BUS) 350 Economics and Business Statistics

Group C

APPLIED SCIENCE AND TECHNOLOGY

Agricultural Communications

AC 311 Communication Methods and Media
 AC 470 Agricultural Communications

Animal Science

ANS 100 Perspectives in Animal Science
 ANS 200 Introduction to Animal Science
 ANS 201 Techniques of Animal Care
 ANS 202 Techniques of Horse Care
 ANS 210 Microcomputers in Animal Production
 ANS 250 Applied Animal Nutrition
 ANS 300 Animal Production Field Study Trip
 ANS (FS,NTR) 301 Introduction to Human Nutrition
 ANS 303 Principles of Equine Evaluation
 ANS 308 Advanced Livestock Judging
 ANS 310 Basic Horse Husbandry
 ANS (FS,PO) 322 Muscle Foods and Eggs
 ANS (FS) 324 Milk and Dairy Products
 ANS 340 Selection of Domestic Animals
 ANS 402 Beef Cattle Management
 ANS 403 Swine Management
 ANS 404 Dairy Cattle Management
 ANS 406 Sheep Management
 ANS 410 Equine Management
 ANS 412 Applied Animal Breeding
 ANS 510 Advanced Livestock Management
 ANS 520 Livestock Production in Warm Climates

Biological and Agricultural Engineering

- BAE 151 Elements of Biological and Agricultural Engineering I
 BAE 201 Shop Processes and Management
 BAE 211 Farm Machinery
 BAE 221 Agricultural Systems I: Microcomputer Applications
 BAE 222 Agricultural Systems II: Methodologies and Approaches
 BAE 241 Computer Applications in Agriculture
 BAE 252 Elements of Biological and Agricultural Engineering II
 BAE 311 Agricultural Power and Machinery
 BAE (NSC) 323 Water Management
 BAE (NSC) 324 Elementary Surveying
 BAE 331 Agricultural Systems III: Management Techniques
 BAE 332 Farm Structures
 BAE 333 Processing Agricultural Products
 BAE 342 Agricultural Processing
 BAE 343 Agricultural Electrification
 BAE 344 Circuits and Controls
 BAE 411 Farm Power and Machinery
 BAE 433 Processing Agricultural Products
 BAE 441 Agricultural Systems IV: Modeling and Analysis
 BAE 442 Agricultural Systems V: Senior Project
 BAE 451 Engineering Design I
 BAE 452 Engineering Design II
 BAE 462 Machinery Design and Applications
 BAE 471 Soil and Water Engineering
 BAE 473 Introduction to Surface Water Quality Modeling
 BAE 481 Agricultural Structures and Environment
 BAE (CE) 576 Agricultural Waste Management

Botany

- BO (S,ENT,PP) 525 Biological Control

Civil Engineering

- CE (BAE) 578 Agricultural Waste Management

Crop Science

- CS 200 Introduction to Turfgrass Management
 CS 213 Crops: Adaptation and Production
 CS 312 Pastures and Forage Crops
 CS 316 Soybean Production
 CS 317 Corn Production
 CS 318 Corn and Soybean Production
 CS 400 Turf Cultural Systems
 CS 411 Environmental Aspects of Crop Production
 CS 413 Plant Breeding
 CS 414 Weed Science
 CS 415 Agronomic Pest Management Systems
 CS (SSC) 462 Soil-Crop Management Systems
 CS 511 Tobacco Technology
 CS 513 Physiological Aspects of Crop Production
 CS (HS) 514 Principles and Methods in Weed Science
 CS (BO,ENT,PP) 525 Biological Control

Entomology

- ENT 203 Introduction to the Honey Bee and Beekeeping
 ENT (BO,CS,PP) 525 Biological Control
 ENT 550 Fundamentals of Insect Control
 ENT 562 Insect Pest Management in Agricultural Crops
 ENT (ZO) 582 Medical and Veterinary Entomology

Fisheries and Wildlife

- FW (ZO) 221 Conservation of Natural Resources
 FW (FOR) 310 Fisheries and Wildlife Inventory and Management
 FW (ZO) 353 Wildlife Management
 FW (ZO) 430 Fisheries-Wildlife Administration
 FW 485 Natural Resources Advocacy

Food Science

- FS 201 Food Science and the Consumer
 FS (ANS,NTR) 301 Introduction to Human Nutrition
 FS (ANS,PO) 322 Muscle Foods and Eggs
 FS (ANS) 324 Milk and Dairy Products
 FS 400 Principles of Human Nutrition
 FS 416 Quality Control of Food Products
 FS 421 Food Preservation
 FS 423 Muscle Food Technology
 FS 425 Processing Dairy Products
 FS (HS) 462 Postharvest Physiology

Genetics

- GN (PO) 520 Poultry Breeding

Horticultural Science

- HS 100 Home Horticulture
 HS 101 Plants for Home and Pleasure
 HS 201 Principles of Horticulture
 HS 211 Ornamental Plants I
 HS 212 Ornamental Plants II
 HS 301 Plant Propagation
 HS 342 Landscape Horticulture
 HS 371 Interior Plantscapes
 HS 400 Residential Landscaping
 HS 411 Nursery Management
 HS 416 Principles of Ornamental Planting Design
 HS 421 Tree Fruit Production
 HS 422 Small Fruit Production
 HS 431 Vegetable Production
 HS 440 Greenhouse Management
 HS 441 Floriculture I
 HS 442 Floriculture II
 HS (FS) 462 Postharvest Physiology
 HS 471 Tree and Ground Maintenance
 HS (CS) 514 Principles and Methods in Weed Science
 HS 531 Physiology of Landscape Plants

Nutrition

- NTR (ANS,FS) 301 Introduction to Human Nutrition

Plant Pathology

- PP 315 Principles of Plant Pathology
 PP (FOR) 318 Forest Pathology
 PP 504 Plant Diseases: Principles, Diagnosis, and Management
 PP 505 Histopathology
 PP 520 Phytopathology I: Nematology
 PP 521 Phytopathology II: Virology
 PP 522 Phytopathology III: Epidemiology
 PP (BO,CS,ENT) 525 Biological Control

Poultry Science

- PO 201 Poultry Science and Production
 PO 301 Evaluation of Live Poultry
 PO (ANS,FS) 322 Muscle Foods and Eggs
 PO 351 Grading and Evaluation of Poultry Products

PO 410 Production and Management of Game Birds in Confinement
PO 420 Turkey Production
PO 421 Commercial Egg Production
PO 422 Incubation and Hatchery Management
PO 423 Broiler Production
PO (GN) 520 Poultry Breeding

Soil Science

SSC (BAE) 323 Water Management
SSC (BAE) 324 Elementary Surveying
SSC 341 Soil Fertility and Fertilizers
SSC 342 Soil Fertility Laboratory
SSC 361 Non-Agricultural Land Use and Management
SSC 370 Alternative Agricultural Systems

SSC 452 Soil Classification
SSC 461 Soil Physical Properties and Plant Growth
SSC (CS) 462 Soil-Crop Management Systems
SSC 472 Forest Soils

Veterinary Science

VMF 401 Poultry Diseases
VMF 420 Diseases of Farm Animals

Zoology

ZO (FW) 221 Conservation of Natural Resources
ZO (FW) 353 Wildlife Management
ZO 419 Limnology
ZO (FW) 430 Fisheries Wildlife Administration
ZO (ENT) 582 Medical and Veterinary Entomology

Group D

HUMANITIES AND SOCIAL SCIENCES¹

The student is required to complete 21 semester hours of Group D courses in all degree programs in the College of Agriculture and Life Sciences. The student must take 6 semester hours from Area I and 6 semester hours from Area II courses. The remaining 9 hours may come from any courses in Area III. Not more than 9 semester hours are to come from one department.

¹Includes only courses in Humanities and Social Sciences on approved Master Lists available from 115 Patterson Hall or faculty adviser.

AREA I

Humanities (6 semester hours)

Courses from approved Master List I in the following disciplines:

English Language Literature
Foreign Language—courses at 200 level or above²
History
History of Art
Music—courses at 200 level or above
Philosophy
Religion

AREA II

Social Sciences (6 semester hours)

Courses from the approved Master List II in the following disciplines:

Agricultural and Resource Economics
Anthropology
Business
Economics
Political Science
Psychology
Sociology

AREA III

Humanities or Social Sciences (9 semester hours)

Courses from any of the three approved Master Lists:

Any Master List I course Humanities
Any Master List II course Social Sciences
Any Master List III course Supplemental courses
(Architecture, Communication, Counselor
Education, Curriculum and Instruction,
Dance, Design, Educational Leadership,
English Language Writing, Foreign
Language, Genetics, Geography,
Humanities and Social Sciences,
Landscape Architecture,
Multidisciplinary Studies, Parks
Recreation and Tourism Management,
Social Work

²Foreign Language at the 100 level may be used to satisfy the College language requirement and Area III (Humanities or Social Sciences supplemental courses) requirements.

Note: All curricula require the completion of one course in literature as a part of their language or Humanities and Social Sciences requirement.

ADULT AND COMMUNITY COLLEGE EDUCATION

(See *Graduate Catalog*)

AGRICULTURAL AND RESOURCE ECONOMICS

Patterson Hall (Room 212)

Professor J. A. Brandt, Head of Department

Professor C. L. Moore, Associate Head and Extension Specialist in Charge

Professor L. A. Ihnen, Undergraduate Coordinator

Professor D. K. Pearce, Economics Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Distinguished University Professor: V. K. Smith

Professors: A. Aronson, A. R. Gallant, T. J. Grennes, D. M. Hoover, P. R. Johnson, T. Johnson, E. C. Pasour, Jr., R. K. Perrin, R. A. Shrinager, M. K. Wohlgemut, Emeriti: Professors: L. E. Daniels, J. E. Fastley, W. D. Eickhoff, E. A. Estes, H. L. Loner, D. F. Neuman, M. L. Walden, R. C. Wells, Emerit Professor: J. B. Hunt, Jr., Professors Emeriti: R. C. Brooks, A. J. Citu, R. D. Dahle, D. G. Harwood, Jr., R. A. King, T. E. Nichols, Jr., R. J. Peeler, G. R. Pugh, J. A. Seagraves, R. L. Summers, J. G. Sutherland (USDA), W. D. Toussaint, W. L. Turner, Emeriti: R. Weathers, J. C. Williamson, Jr., Associate Professors: G. A. Benson, D. L. Hoag, C. F. Safley, W. N. Thurman, K. D. Zering, Associate Professors Emeriti: J. C. A. Good, R. S. Boal, H. C. Glean, Jr., D. D. Robinson, P. S. Stone, Assistant Professors: J. C. Beghin, A. R. Brown, P. L. Faulkner, W. E. Foster, A. R. Ottobrus, M. A. Renkow, Assistant Professors Emeriti: J. C. Matthews, Jr., E. M. Stang, Lecturers: A. M. Beals, Jr., S. L. Robinson, H. A. Sampson, III, Adjunct Instructor: W. A. Graham, III, Extension Specialist: A. C. Andry, IV, R. N. Barnes, R. H. Ury.

The Department of Agricultural and Resource Economics serves agricultural, resource and related industries through its extension, research and teaching programs. Applying principles of economics and related disciplines, these programs develop understanding of contemporary economic and business problems and equip students with a knowledge of business organization fundamentals and decision-making skills useful in the operation and management of business firms.

The Department offers undergraduate programs leading to Bachelor of Science degrees in agricultural business management and in agricultural economics. A concentration in biological sciences business management is offered within the agricultural business management program. The Department also offers a natural resources economics and management concentration within the campus wide degree program leading to a Bachelor of Science degree in natural resources. See natural resources curriculum.

The agricultural business management program prepares graduates for management, marketing, sales, finance and related careers. The agricultural economics program provides a similar background in economics and business, together with the opportunity for more extensive coursework in basic and applied sciences, and it prepares graduates for business careers and advanced study. The concentration in biological sciences business management prepares graduates for management, marketing, and sales careers in fields such as biotechnology, pharmaceuticals, health care, environmental protection, food processing and finance dealing with biological issues. This concentration is designed to be an attractive option for students with a strong background and interest in science who seek alternatives to technical science careers. The natural resources economics and management curriculum prepares graduates for careers as managers and administrators with businesses and government agencies responsible for natural resources development and or waste management.

For a description of related programs offered within the College of Management, see the listings for the Departments of Accounting, Business Management and Economics.

OPPORTUNITIES

The growing number of specialized business firms producing and marketing services and products in agriculture, resource and life science-related industries has created an increasing demand for graduates trained in agricultural and biological sciences business management, agricultural economics and resource economics and management. Employment opportunities include careers with companies purchasing, processing and marketing food, fiber and related products; firms producing and marketing production inputs (feed, equipment, chemicals, drugs, etc.) and services; banks; other financial and credit agencies; cooperatives; natural resources management units and consulting firms; and natural resources educational and regulatory agencies.

Many graduates pursue careers in research and education with various state and federal government agencies. These agencies include the Cooperative Extension Service, the Agricultural Research Service, the State Department of Agriculture, Environmental Health and Natural Resources, the United States Department of Agriculture and the Environmental Protection Agency.

CURRICULUM IN AGRICULTURAL BUSINESS MANAGEMENT

	<i>Credits</i>		
ALS 103	1	<i>Physical Education and Free Electives (17 Credits)</i>	
		PE 10K	1
		Physical Education Elective	3
		Free Electives	13
		<i>Departmental Requirements and Electives (50 Credits)</i>	
		ACC 210	3
		ACC 280	3
		ARE 303	3
		BUSEC 310	3
		ARE 306	3
		BUS 307	3
		ARE 311	3
		BUS 360	3
		ARE 321	3
		BUS 320	3
		BUS/E(*) 404	3
		BUS 330	3
		BUS 332	3
		EC 431	3
		BUS(ST) 350	3
		EC/ARE) 301	3
		EC 302	3
		ARE 433	3
		<i>Technical Agricultural Electives (from Group C or Forestry) 9</i>	
		<i>Departmental or Technical Agriculture Electives 11</i>	
		Minimum Hours Required for Graduation 130	
ALS 103	1	<i>Humanities and Social Sciences (21 Credits)</i>	
		ARE 212	3
		ARE/EC) 301	3
		COM 201	3
		HI 322	3
		HI 441	3
		<i>Elective (Ethics, Philosophy or Religion) 4</i>	
		<i>Elective (Group D) 3</i>	

CURRICULUM IN AGRICULTURAL BUSINESS MANAGEMENT WITH CONCENTRATION IN BIOLOGICAL SCIENCES

	<i>Credits</i>		
ALS 103	1	<i>Humanities and Social Sciences (21 Credits)</i>	
		ARE 212	3
		ARE/EC) 301	3
		COM 201	3
		HI 322	3
		HI 441	3
		<i>Elective (Ethics, Philosophy or Religion) 4</i>	
		<i>Elective (Group D) 3</i>	

*Physical and Biological Sciences
(11 Credits)*

BAE 221	Agri. Mechanization/Computer Appl. or	
BAE 241	Computer Appl. in ALS	5
BO 200	Plant Life or	
MB 401	General Microbiology	4
BO(ZO) 360	Intro. to Ecology and	
BO(ZO) 365	Ecology Laboratory or	
BO 108	Plant Diversity or	
ZO 303	Vertebrate Zoology and	
ZO 301	Vertebrate Zoology Lab or	
ZO 450	Evolutionary Biology	4
BS 100	General Biology	4
CH 101	General Chemistry I	3
CH 121	General Chemistry Laboratory	1
CH 107	Principles of Chemistry	4
CH 127	Principles of Chemistry Lab	1
GN 301	Genetics in Human Affairs or	
GN 111	Principles of Genetics	3
MA 114	Intro. to Finite Math. or	
MA 231	Analyt. Geometry & Calculus B	4
MA 121	Elements of Calculus or	
MA 141	Analyt. Geometry & Calculus A	4
PY 221	College Physics	5
ZO 201	General Zoology or	
ZO 205	Intro. Cell & Dev. Zool. or	
ZO 208	Intro. Org. & Evol. Zool.	4

*Physical Education and Free Electives
(6 Credits)*

PE 100	Health and Physical Fitness	1
	Physical Education Electives	3
	Free Electives	12

*Departmental Requirements and Electives
(49 Credits)*

ACC 280	Managerial Accounting or	
ACC 220	Accounting II	3
ARE 306	Agricultural Law	3
ARE 311	Agricultural Markets or	
BUS 360	Marketing Methods	4
ARE 321	Agri. Financial Mgmt. or	
BUS 320	Financial Management	3
BUS/EC 310	Managerial Economics	3
BUS/ST 350	Econ. & Bus. Stat. or	
ST 361	Intro. Stat. for Engineers	4
EC 302	Intermediate Macroeconomics	3
ENG 331	Commun. for Engr. & Tech. or	
ENG 332	Commun. for Bus. Mgt. or	
ENG 333	Commun. for Sci. & Res.	3
	Departmental Elective (from ARE	
	courses)	3
	Departmental Electives (ARE or other	
	CALS Electives)	12
	Minimum Hours Required for Graduation	130*

*Must include at least 6 hours of 400 or 500 level courses.

MINOR IN AGRICULTURAL BUSINESS MANAGEMENT

The Department of Agricultural and Resource Economics offers a minor in Agricultural Business Management. This minor provides students an opportunity to learn basic concepts useful in many careers in agricultural business. A total of 15 hours of coursework is required, including ARE 212, ACC 280, ARE 303 or ARE 311 and two additional courses chosen from a list of selected courses in agricultural and resource economics and related business fields. Consult the Department for specific information.

CURRICULUM IN AGRICULTURAL ECONOMICS

SCIENCE PROGRAM

ALS 103	Introductory Topics in ALS	1	<i>Credits</i>
	<i>Language (12 Credits)</i>		
ENG 111	Composition and Rhetoric	3	
ENG 112	Composition and Reading	3	
	Elective (English or foreign language		
	literature)	3	
	Elective (Language or Communication)	3	
	<i>Humanities & Soc. Sciences (12 Credits)</i>		
ARE 212	Economics of Agriculture	3	
EC 202	Economic Problems & Issues	3	
	Electives (Group D)	15	
	<i>Physical and Biological Sciences (16 Credits)</i>		
BS 100	General Biology or		
BS 105	Biology in the Modern World	4	
CH 101	General Chemistry I	3	
CH 121	General Chemistry I Laboratory	1	

CH 107	Principles of Chemistry	3
CH 127	Principles of Chemistry Lab	1
CSC 200	Intro. to Computers & Uses or	
BAE 241	Computer Applications in ALS	3
MA 111	Precalculus Algebra and	
	Trigonometry	3
MA 114	Intro. to Finite Math. Appl.	3
MA 131	Analytic Geometry & Calculus A	4
MA 231	Analytic Geometry & Calculus B	3
PY 221	College Physics	5
	Bio. Sci. Elective From Group A or	
	GN 301, NTR 301 or SSC 200)	3

*Physical Education and Free Electives
(17 Credits)*

PE 100	Health and Physical Fitness	1
	Physical Education Elective	3
	Free Elective	13

*Group A and C Electives
(11 Credits)*

Electives	11
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<i>Departmental Requirement, and Electives</i> (42 Credits)	
ACC 210 Accounting I or	
ACC 280 Managerial Accounting	3
ARE(EC) 301 Intermed. Macroeconomics	3
ARE 433 U.S. Agricultural Policy	3
BUS(ST) 350 Econ. & Bus. Statistics	3

EC 302 Intermediate Macroeconomics	3
Electives (ARE 303,311,312,321,336,423, 436,515,521,523,533 or 551)	9
Electives (Any ARE, ACC, BUS, EC) or other course approved by Undergraduate Coordinator	6
Minimum Hours Required for Graduation:	130

MINOR IN AGRICULTURAL ECONOMICS

The Department of Agricultural and Resource Economics offers a minor in Agricultural Economics. This minor provides students an introduction to agricultural economics training that complements training in agriculture and applied sciences and will be especially useful for further training at the graduate level. A total of 15 hours of coursework is required, including ARE 212 or EC 201, ARE(EC) 301, ARE 433 and two additional courses chosen from a list of selected courses in agricultural and resource economics and related fields. Consult the Department for additional information.

AGRONOMY

Williams Hall

Professor W. K. Collins, Acting Head of the Crop Science Department

Professor E. J. Kamprath, Head of the Soil Science Department

Professor J. M. DiPaola, Undergraduate Coordinator Crop Science

Associate Professor H. J. Kleiss, Undergraduate Coordinator Soil Science

Agronomy is the development and practical application of plant and soil sciences to produce abundant, high quality food, feed, fiber and other crops. Agronomists serve a vital role in world agriculture and environmental quality. Students may earn a Bachelor of Science degree under the technology curriculum of the College of Agriculture and Life Sciences with a major in Agronomy. The agronomy curriculum is administered jointly by the Departments of Crop Science and Soil Science. Crop Science related primarily to the genetics, breeding, physiology, and management of field crops and turf. Soil science is oriented toward soil physics, chemistry, origin, microbiology, fertility, and management. For further information, see Crop Science or Soil Science.

AGRONOMY CURRICULUM REQUIREMENTS

	<i>Credits</i>
ALS Introductory Topics in ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition & Rhetoric	3
ENG 112 Composition & Reading	3
COM 110 Public Speaking	3
ENG 331 Commun. for Eng. & Tech.	3
<i>Social Sciences & Humanities</i> (21 Credits)	
ARE 212 Economics of Agriculture	3
EC 202 Economic Problems and Issues (for TAB only)	3
Literature Elective	3
Electives (Group D, Areas I, II, and III)	12 15
<i>Physical & Biological Sciences</i> (45-48 Credits)	
MA 121 Elements of Calculus and	
BAE 221 Ag Sys. I: Computer Appl. or	

CSC 200 Intro. to Computers & Their Use in	
ST 311 Intro. to Statistics (TAB, TAA, TAT, TSS)	
<i>OR</i>	
MA 131 Analy. Geom. & Calculus A and	
MA 231 Analy. Geom. & Calculus B	
(TAA only)	7
CH 101 General Chemistry	3
CH 121 General Chemistry Lab	1
CH 107 Principles of Chemistry	3
CH 127 Principles of Chemistry Lab	1
PY 221 College Physics	5
BO 200 Plant Life	1
BS 100 General Biology	1
GN 301 Genetics in Human Affairs or	
GN 411 Principles of Genetics	
(TAA only)	3 1
SSC 200 Soil Science	4

<i>Physical Education & Free Electives</i>	
<i>(13-15 Credits)</i>	
PE 100 Health & Physical Fitness	1
PE Electives	3
Free Electives	B-11
<i>Agronomy (26 Credits)</i>	
CS 213 Crops: Adapt. & Production	4
CS 411 Envir Aspects of Crop Production	2
CS 414 Weed Science	4
SSC (CS) 490 Senior Seminar	1
SSC 341 Soil Fertility & Fert.	3
SSC 342 Soil Fert. & Fert. Lab	1
SSC 452 Soil Classification	4
CH 220 Intro. to Org. Chem. or	
CH 221 Organic Chemistry I	
(TAA only)	4
CS (SSC) 415 Agronomic Pest Mgt. Sys.	3
<i>Agronomy Concentrations</i>	
<i>(19-22 Credits)</i>	
<i>Agronomic Sciences (TAA)</i>	
CH 223 Organic Chemistry II	4
MB 401 Gen. Microbiology	4
BCH 451 Elem. Biochemistry	3
BO 421 Plant Physiology	4
PP 315 Prin. of Plant Pathology or	
ENT 425 General Entomology	3-4
CS 413 Plant Breeding	2
Minimum Hours Required for Graduation ... 129	
<i>Agronomic Business (TAB)</i>	
BO 421 Plant Physiology	4
PP 315 Prin. of Plant Pathology or	
ENT 425 Gen. Entomology	3-4
ACC 280 Managerial Accounting	3

ARE 303 Farm Management	3
ARE 311 Agricultural Markets	3
SSC (CS) 462 Soil Crop Mgt. Systems	3
Minimum Hours Required for Graduation ... 128	
<i>Crop Production (TAC)</i>	
BO 421 Plant Physiology	4
PP 315 Prin. of Plant Pathology or	
ENT 425 General Entomology	3-4
ARE 303 Farm Management	3
SSC (CS) 462 Soil-Crop Mgt. Systems	3
CS 312 Pastures & Forages	3
CS 413 Plant Breeding	2
SSC 461 Soil Phys. Prop. & Plant Growth	3
Minimum Hours Required for Graduation ... 130	
<i>Turfgrass Management (TAT)</i>	
BO 421 Plant Physiology	4
PP 315 Prin. of Plant Pathology or	
Ent 425 General Entomology	3-4
CS 400 Turf Cultural Systems	4
CS 200 Intro. Turf Management	3
HS 342 Landscape Hort. or	
HS 371 Interior Plantscapes or	
HS 471 Trees & Ground Maintenance	3-4
SSC 461 Soil Phys. Prop. & Plant Growth	3
Minimum Hours Required for Graduation ... 129	
<i>Soil Science (TSS)</i>	
MB 401 Gen. Microbiology	4
SSC (CS) 462 Soil-Crop Mgt. Systems	3
SSC 361 Non Ag. Land Use & Management	3
BAE (SSC) 323 Water Management	3
BAE 324 Elementary Surveying	1
MEA 101 Gen. Physical Geology	3
MEA 110 Physical Geology Lab	1
SSC 461 Soil Phys. Prop. & Plant Growth	3
Minimum Hours Required for Graduation ... 129	

ANIMAL SCIENCE

Polk Hall

Professor L. S. Bull, Head

Professor D. G. Braund, Associate Head for Extension

Alumni Distinguished Professor J. C. Cornwell, Undergraduate Coordinator

William Neal Reynolds Professor E. J. Eisen, Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Alumni Distinguished Associate Professor K. R. Pond

William Neal Reynolds Professor J. G. Lecce

Professors: K. R. Butcher, E. V. Caruolo, R. G. Crickenberger, W. J. Croom, D. G. Davenport, K. L. Esbenshade, R. W. Harvey, W. L. Johnson, E. E. Jones, J. R. Jones, R. L. McCraw, B. T. McDaniel, R. A. Mowrey, Jr., R. M. Petters, B. R. Poulton, A. H. Rakes, H. A. Ramsey, O. W. Robison, F. D. Sargent, J. W. Spears, C. M. Stanislaw, D. P. Wesen, L. W. Whitlow, J. C. Wilk; *Adjunct Professors:* S. D. Perreault; *Professors Emeriti:* A. V. Allen, T. C. Blalock, E. R. Barrick, R. F. Behlow, A. J. Clawson, L. Goode, G. Hyatt, Jr., F. N. Knott, C. A. Lassiter, J. M. Leatherwood, J. E. Legates, R. D. Mochrie, R. M. Myers, G. S. Parsons, J. W. Patterson, I. D. Porterfield, F. H. Smith, L. C. Ulberg, G. H. Wise, J. R. Woodard; *Associate Professors:* B. P. Alston-Mills, J. D. Armstrong, J. H. Eisemann, R. E. Lichtenwalner, S. P. Washburn, M. D. Whitacre; *Adjunct Associate Professors:* M. T. Coffey, F. C. Gunsett, E. C. Serguson, Jr.; *Associate Professors Emeriti:* E. U. Dillard, J. J. McNeill; *Assistant Professors:* C. E. Farin, W. L. Flowers, J. A. Hansen, B. A. Hopkins, W. E. Morgan Morrow, M. H. Poore, M. T. See; *Lecturer:* D. T. Barnett; *Extension Specialists:* B. C. Allison.

Animal Science is a broad field centered on the biology, production, management, and care of domestic animals. Animals have, throughout history, provided man with a major source of food, fiber, pleasure and companionship. Undergraduate students study subjects related to various phases of animal science. Courses are offered in anatomy, physiology, nutrition, genetics, and management, and there are opportunities for the application of basic scientific training in the husbandry areas. Options for course selection by each student make it possible for those with varying backgrounds and wide ranging interests to become involved in stimulating and rewarding experiences.

OPPORTUNITIES

Opportunities for animal scientists are boundless and the areas of emphasis are diverse. Animal science graduates are qualified for positions in a wide variety of areas such as: livestock production, animal management, feed and animal health product companies, livestock marketing, food processing industries, feedlot managers, management consultants, state and federal departments of agriculture, breed associations, education, financial institutions, livestock publications, technical service managers, animal technicians, media specialists, agricultural extension service and public relations. Animal scientists can be found across the nation and round the world in all phases of production, research, sales, service, business and education. Many students in pre-veterinary medicine obtain degrees in animal science. Students may elect graduate study, after which they will find opportunities in teaching, research, and extension. See listing of graduate degrees offered.

CURRICULA IN ANIMAL SCIENCE

The degree of Bachelor of Science with a major in animal science may be obtained under either the science or industry curricula offered in the College of Agriculture and Life Sciences. The science curriculum (SAS) is designed for students with interest in advanced study in disciplines such as physiology, nutrition, and genetics. Many students in pre-veterinary medicine (SPV) are enrolled in this curriculum pursuing a Bachelor of Science Degree in Animal Science. The industry (IAS) curriculum is for students interested in entry into the animal industry or allied businesses. It offers flexibility in complementing animal science with business, economics, and applied science course work.

SCIENCE PROGRAM

		<i>Credits</i>			<i>Natural Sciences (14 Credits)</i>
ALS 103	Introductory Topics	1	BS 100	General Biology	4
	<i>English Composition & Communication</i>		CH 101	General Chemistry	3
	<i>(12 Credits)</i>		CH 121	General Chemistry I Lab	1
ENG 111	Composition & Rhetoric	3	CH 107	Principles of Chemistry	3
ENG 112	Composition & Reading	3	CH 127	Principles of Chemistry Lab	1
COM 110	Public Speaking	3	PY 211	College Physics I	1
ENG 331	Comm. for Eng. & Tech. or	3	PY 212	College Physics II	4
ENG 332	Comm. for Bus. Mgt. or	3	GN 411	Principles Genetics	4
ENG 333	Comm. for Sci. & Research	3		<i>Restricted Electives (22 Credits)</i>	
	<i>Humanities & Social Sciences</i>		CH 221	Organic Chemistry I	4
	<i>(21 Credits)</i>		CH 223	Organic Chemistry II	4
ARE 212	Economics of Agriculture	3	MB 401	General Microbiology	4
	Literature Elective	4	ST 311	Introduction to Statistics	3
	Humanities Elective	3		Group A, B, or C	7
	Social Sciences Elective	3		(Recommended BI H 451 Intro. Biochemistry	
	Humanities or Social Sciences	9		& ANS 210, Microcomputers in Anim. Prod. or	
	<i>Mathematics (7 Credits)</i>			BAE 221, Agric. Sys. I-Microcomp. Appl.)	
MA 111	Algebra & Trigonometry ¹	3			
MA 121	Elements of Calculus or	3			
MA 131	Analytic Geometry & Calculus A	4			

<i>Departmental Requirements (15 Credits)</i>	
ANS 100 Perspectives in Animal Science	1
ANS 130 Anatomy & Physiology Dom. Animals	3
ANS 220 Reprod. Lact. & Behav. Dom. Animals	3
ANS 230 Genetics, Nutr. & Growth Dom. Animals	4
ANS 490 Seminar in Animal Science	2

Departmental Electives (12 Credits)

(Select 12 credits. 4 credit hours must be from management courses)**

ANS 210 Microcomputers in Animal Production	2
ANS 250 Applied Animal Nutrition	3
ANS 303 Principles of Equine Evaluation	2
ANS 310 Basic Horse Husbandry	3
ANS (FS, PO) 322 Muscle Foods & Eggs	3

INDUSTRY PROGRAM

	<i>Credits</i>
ALS 103 Introductory Topics	1

English Composition & Communication (12 Credits)

ENG 111 Composition & Rhetoric	3
ENG 112 Composition & Reading	3
COM 110 Public Speaking	3
ENG 341 Comm. for Eng. & Tech. or	
ENG 342 Comm. for Bus. Mgt. or	
ENG 344 Comm. for Sci.	3

Humanities & Social Sciences (21 Credits)

ARE 212 Economics of Agriculture	3
Literature Elective	3
Humanities Elective	3
Social Sciences Elective	3
Humanities or Social Sciences Electives	9

Mathematics (7 Credits)

MA 111 Pre-calculus Algebra & Trigonometry	3
MA 121 Elements of Calculus or	
MA 131 Analytic Geometry & Calculus A	4

Natural Sciences (10 Credits)

BS 100 General Biology	4
CH 101 General Chemistry ¹	3
CH 121 General Chemistry Lab	1
CH 107 Principles of Chemistry	3
CH 127 Principles of Chemistry Lab	1
PY 211 College Physics I	4
PY 212 College Physics II	4
GN 301 Genetics in Human Affairs	3

Restricted Electives (23 Credits)

CH 220 Introductory Organic Chemistry or	
CH 221 Organic Chemistry I	4
ST 311 Introduction to Statistics	3
Group A, B, or C	16
(Recommend MB 401, Gen. Micro., ANS 210, Microcomp. in Anm. Prod. or BAE 221, Agric. Sys 1 Microcomp. Applic., CS 312, Pastures & Forage Crops and ARE 303, Farm Management)	

ANS (FS) 324 Milk & Dairy Products	2
ANS 340 Selection Domestic Animals	3
ANS 402 Beef Cattle Management**	3
ANS 403 Swine Management**	3
ANS 404 Dairy Cattle Management**	3
ANS 406 Sheep Management**	3
ANS 410 Equine Management**	3
ANS 412 Applied Animal Breeding	14
ANS (INTR, PO) 415 Comparative Nutrition	3
VMF 420 Diseases of Farm Animals	3

Physical Education & Free Electives (16 Credits)

PE 100 Health & Physical Fitness	1
Physical Education Electives	3
Free Electives	12

Minimum Hours Required for Graduation ... 130

¹Must be completed with a grade of C or better.

Departmental Requirements (15 Credits)

ANS 100 Perspectives in Animal Science	1
ANS 130 Anatomy & Physiology of Dom. Anim.	4
ANS 220 Reprod. Lact. & Behav. Dom. Anim.	4
ANS 230 Genetics, Nutr. & Growth Dom. Anim.	4
ANS 490 Seminar in Animal Science	2

Department Electives

(Select 12 credits. 6 credits must be from management courses)**

ANS 210 Microcomputer in Animal Production	2
ANS 250 Applied Animal Nutrition	3
ANS 303 Principles Equine Evaluation	2
ANS 310 Basic Horse Husbandry	3
ANS (FS, PO) 322 Muscle Foods and Eggs	3
ANS (FS) 324 Milk and Dairy Products	2
ANS 340 Selection Domestic Animals	3
ANS 402 Beef Cattle Management**	3
ANS 403 Swine Management**	3
ANS 404 Dairy Cattle Management**	3
ANS 406 Sheep Management**	3
ANS 410 Equine Management**	3
ANS 412 Applied Animal Breeding	14
ANS (NTR, PO) 415 Comparative Nutrition	3
VMF 420 Diseases of Farm Animals	3

Physical Education & Free Electives (16 Credits)

PE 100 Health & Physical Fitness	1
Physical Education Electives	3
Free Electives	12

Minimum Hours Required for Graduation ... 130

¹Must be completed with a grade C or better.

MINOR IN ANIMAL SCIENCE

A minor in Animal Science is open to all interested baccalaureate students. It is designed primarily to complement curricula in Agricultural Business Management, Agricultural Economics, Agricultural Education, Agronomy, Food Science, Poultry Science, and Zoology. Students completing a minor in Animal Science will become familiar with animal production and with its related industries, their fundamental components, terminology, and dynamic nature. The minor requires a minimum of 15 credit hours, and its course of study is flexible in order that students may emphasize the discipline or species of their interest.

BIOCHEMISTRY

Polk Hall (Room 128)

Professor P. F. Agris, *Head of the Department*

Alumni Distinguished Undergraduate Professor and William Neal Reynolds Professor: H. R. Horton, *Undergraduate Coordinator*

Professor J. D. Otvos, *Graduate Coordinator*

TEACHING, RESEARCH AND EXTENSION FACULTY

University Professor: E. C. Theil

Professors: H. M. Hassan, W. L. Miller, E. C. Siler *Adjunct Professor* K. S. Korach; *Professors Emeriti:* F. B. Armstrong, J. S. Kahn, I. S. Longmair, S. B. Tove; *Associate Professors:* J. A. Knopp, E. S. Maxwell, P. L. Wollenzien; *Adjunct Associate Professor:* E. L. Treadwell; *Assistant Professors:* L. K. Hanley Bowdoin, C. C. Hardin, C. L. Hemenway; *Visiting Assistant Professor:* H. S. Graetz; *Associate Members of the Faculty:* R. R. Sederoff (Forestry, Genetics), H. E. Swaisgood (Food Science), D. E. Sayers (Physics).

The Biochemistry program provides B. S. graduates with the scientific background and skills required for employment in university, industrial, state, and federal research laboratories. The curriculum is especially suited to students preparing for graduate study in biochemistry, molecular biology, biotechnology, medicine, and related fields. It emphasizes the fundamentals of biological and physical sciences, offering students breadth of knowledge and depth of understanding. The curriculum provides students with broad experience in biological and chemical laboratories and encourages the development of experimental skills. Opportunities are provided for highly qualified students to undertake honors research during their junior and/or senior years.

BIOCHEMISTRY CURRICULUM

	<i>Credits</i>		
ALS 103 Introductory Topics in ALS	1	Computer, Mathematics or Statistics elective (3)	3
		PY 205 ¹ , 208 General Physics for Engineers and Scientists I and II(4,4)	
		<i>or</i>	
<i>Languages (12 Credits)</i>		PY 211, 212 College Physics I, II(4,4)	8
ENG 111 Composition and Rhetoric	3	<i>Chemistry and Laboratory Analysis</i>	
ENG 112 Composition and Reading	3	<i>(23-26 Credits)</i>	
Foreign Language Elective	6	CH 101, 121, 107, General Chemistry (3,1,3,1)	8
		CH 221, 223 Organic Chemistry I and II(4,4)	8
<i>Humanities and Social Sciences</i>		CH 431 ¹ , 433 ¹ Physical Chemistry I and II(3,3)	
<i>(4 Credits)</i>		<i>or</i>	
Electives must include 6 credit hours each from both the humanities and the social sciences	21	CH 331 Introductory Physical Chemistry	6
Also, at least one literature course must be included within the required 21 credit hours.		Laboratory Analysis electives:	
		e.g. CH 315 (4) or CH 428 ¹ (3)	13
<i>Mathematical Sciences and Physics</i>			
<i>(21-23 Credits)</i>			
MA 141 ¹ , 241 ¹ , 242 Analytic Geometry and Calculus I, II, and III(4,4,4)			
		<i>or</i>	
MA 131, 231, ST 311 Analytic Geometry and Calculus A and B(4,3) and Introduction to Statistics(3)	12 ¹ 10		

<i>Life Sciences (34-35 Credits)</i>	
BS 100 General Biology	4
Life Sciences electives (must include both animal and plant science courses, and a course in physiology or cell biology)	11-12
BCH 150 Introductory Biochemical Concepts	2
BCH 461, 462 Introductory Biochemistry and Lab (3.2)	5
BCH 463 Introduction to Molecular Biology and Metabolism	3
MB 401 General Microbiology	4
GN 411 Principles of Genetics	4
Laboratory or Library Research (e.g., BCH 490)	1

<i>Electives (16-18 Credits)</i>	
Technical electives (Advised)	0-2
Free electives	12
Physical Education (PE 100 plus Physical Education Electives)	4
Minimum Hours Required for Graduation ...	130

¹Recommended for students preparing for graduate study in Biochemistry

BIOLOGICAL AND AGRICULTURAL ENGINEERING

(Also see Engineering)

David S. Weaver Laboratories (Room 100)

Professor D. B. Beasley, Head of Department

Professor F. J. Humenik, Associate Head in Charge of Extension

Professor C. F. Abrams, Jr., Graduate Coordinator

Professor J. H. Young, Undergraduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Distinguished University Professor and William Neal Reynolds Professor: R. W. Skaggs

Professors: J. C. Barker, L. B. Driggers, E. G. Humphries, W. H. Johnson, G. J. Kriz, W. F. McClure, R. E. Phillips, R. P. Rohrbach, L. M. Saffley, Jr., R. E. Sneed, R. S. Sowell, L. F. Stikeleather, C. W. Suggs, P. W. Westerman, T. B. Whitaker (USDA), D. H. Willits; Professors Emeriti: E. O. Beasley, G. B. Blum, Jr., H. D. Bowen, J. W. Dickens, H. M. Ellis, J. M. Fore, G. W. Giles, J. W. Glover, F. J. Hassler, E. L. Howell, D. H. Howells, R. W. Watkins, J. W. Weaver, Jr., E. H. Waiser; Associate Professors: G. R. Baughman, R. W. Bottcher, C. G. Bowers, Jr., A. R. Rubin; Adjunct Associate Professor: D. C. Richardson; Associate Professor Emeritus: W. C. Warrick; Assistant Professors: M. D. Boyette, R. O. Evans, R. L. Huffman, G. D. Jennings, J. E. Parsons; Adjunct Assistant Professors: G. M. Jividen, S. K. Seymour; Instructor: G. T. Roberson; Senior Researchers: S. C. Mohapatra; Research Associate: G. M. Chescheir; Extension Specialists: J. A. Arnold, S. W. Coffey, J. A. Gale, D. E. Line, R. L. McLymore, J. M. Rice, J. Spooner; Associate Members of the Faculty: D. D. Hamann (Food Science), A. E. Hassan (Forestry), V. A. Jones (Food Science), T. M. Losordo (Zoology), S. C. Roe (Companion Animal & Special Species Medicine), K. R. Swartzel (Food Science).

Biological and Agricultural Engineering is the engineering discipline that uses engineering principles to solve problems and improve situations involving biological and agricultural systems. The goals are to improve efficiency, conserve natural resources, protect the environment and, in general, to contribute to improving the quality of life as impacted by biological and agricultural systems.

Two curricula are offered, Biological and Agricultural Engineering and Agricultural Systems Technology. The Biological and Agricultural Engineering curriculum, which is accredited by the Accreditation Board of Engineering and Technology (ABET), leads to the degree Bachelor of Science in Biological and Agricultural Engineering. Graduates of the Agricultural Systems Technology curriculum receive the degree Bachelor of Science in Agricultural Systems Technology.

OPPORTUNITIES

Graduates of the Biological and Agricultural Engineering curriculum are qualified for positions in design, development and research in public institutions and in industry. This curriculum also provides adequate preparation for post-graduate work leading to

advanced degrees. (See listing of graduate degrees offered.) Those receiving degrees in Agricultural Systems Technology are qualified for positions in sales, services, and management of agribusinesses such as farm machinery, irrigation systems, etc.; as county agents or farmers; and for various types of agricultural advisory work.

CURRICULUM IN BIOLOGICAL AND AGRICULTURAL ENGINEERING ENGINEERING PROGRAM

The engineering curriculum provides an educational program for students which uniquely prepares them for dealing with engineering problems in the biological and agricultural areas. Emphasis is placed on basic science and engineering courses such as mathematics, physics, mechanics, biology, soils, and thermodynamics which provide a sound background for the application of engineering to agricultural and biological problems.

Since biological and agricultural engineering involves the disciplines of biology, agriculture and engineering, the curriculum is jointly administered by the Colleges of Agriculture and Life Sciences and Engineering. Undergraduate freshmen entering this curriculum should enroll in the College of Engineering undesignated program and indicate BAU as their curriculum choice. After successfully completing the Engineering undesignated requirements the student will enter the Department of Biological and Agricultural Engineering.

For the engineering program in biological and agricultural engineering, refer to the College of Engineering section of the catalog.

AGRICULTURAL SYSTEMS TECHNOLOGY CURRICULUM

The Agricultural Systems Technology curriculum is intended to provide a broad overview of agricultural systems. The curriculum integrates courses from the physical, biological, and earth sciences with courses in agricultural production, mechanization, and management. Graduates are prepared to apply shop, mechanical, and information technology to the farm or agribusiness.

Listed below are the departmental requirements in the agricultural systems technology program.

	<i>Credits</i>		
ALS 100 Introductory Topics in ALS	1	CH 107 Principles of Chemistry	3
E 115 Intro. Computing Envir	1	CH 127 Principles of Chemistry Laboratory	1
<i>Language (12 Credits)</i>		PY 211 College Physics I	4
ENG 111 Composition and Rhetoric	3	PY 212 College Physics II	4
ENG 112 Composition and Reading	3	SSC 200 Soil Science	4
COM 110 Public Speaking	3	Group A Electives (Biological Science)	4
Literature Elective	3	<i>Physical Education and Free Electives (16 Credits)</i>	
<i>Humanities and Social Sciences (21 Credits)</i>		PE 100 Health & Physical Fitness	1
Group D Electives	12	Physical Education Electives	3
ARE 212 Economics of Agriculture	3	Free Electives	12
ENG 331 Commun. for Engr. & Tech.	3	<i>Departmental Requirements and Electives (48 Credits)</i>	
SOC 241 Sociology Agr. and Rural Life	3	BAE 201 Shop Processes and Management	3
<i>Mathematics and Statistics (12 Credits)</i>		BAE 211 Farm Machinery	3
MA 111 Precalculus Algebra and Trigonometry	3	BAE 221 Agr. Systems I	3
MA 114 Intro. to Finite Math	4	BAE 222 Agr. Systems II	2
MA 131 Analytic Geometry and Calculus A	4	BAE 311 Agr. Power and Machinery	3
ST (BUS) 350 Economics and Business Statistics or	3	BAE (SSC) 323 Water Management	3
ST 361 Intro. to Statistics for Eng. neers	3	BAE (SSC) 324 Elementary Surveying	1
<i>Physical and Biological Sciences (28 Credits)</i>		BAE 331 Agr. Systems III	2
BS 100 General Biology	4	BAE 332 Farm Structures	3
CH 101 General Chemistry I	3	BAE 333 Processing Agr. Products	4
CH 121 General Chemistry Laboratory	1	BAE 443 Agr. Electrification	1
		BAE 444 Circuits and Controls	1
		BAE 441 Agr. Systems IV	3
		BAE 442 Agr. Systems V	2
		GC 101 Engineering Graphics I	2
		Minimum Hours Required for Graduation	128

MINOR IN AGRICULTURAL SYSTEMS TECHNOLOGY

The undergraduate academic minor in Agricultural Systems Technology is offered to students interested in applications of engineering technology and systems analysis to various areas of agriculture such as machinery, structures, food and feed processing and soil and water management. The program allows majors in other areas to apply engineering technology and information technology to equipment, materials, resources or processes.

BIOLOGICAL SCIENCES

Bostian Hall (Room 2717)

Professor C. F. Lytle, Coordinator

Assistant Professor J. E. Mickle, Undergraduate Coordinator

Associate Professors: R. L. Beckmann, Jr. (Botany), M. Niedzlek-Feaver (Zoology), B. C. Haning (Plant Pathology), B. M. Parker (Entomology); Teaching Technicians: W. P. Crumpler (Microbiology), C. W. Parker (Adult and Community College Education)

The Biological Sciences constitute a rapidly developing field offering many challenging and rewarding opportunities for well-trained students. The Biological Sciences Interdepartmental Program offers a B.S. degree in Biological Sciences for students seeking comprehensive training in biology and the supporting sciences.

Many graduates of this program continue further studies in graduate schools in such diverse fields as botany, zoology, marine biology, physiology, genetics, biochemistry, biotechnology, pharmacology, and microbiology. Others attend professional schools in medicine, optometry, and veterinary medicine as well as other health-related fields.

The Biological Sciences curriculum provides a modern, flexible undergraduate program to prepare students for rewarding careers in research and teaching as well as in business, industry, research institutes and governmental agencies. A wide range of career opportunities are available in technical sales, manufacturing and quality control, environmental management, and other positions with pharmaceutical companies, food manufacturers, medical laboratories, public utilities, and other industries.

Biological Sciences majors may elect a general program of study or the Nutrition concentration option. A joint program with the Department of Mathematics and Science Education leads to a double major and a teaching certificate.

BIOLOGICAL SCIENCES CURRICULUM AND CONCENTRATIONS

GENERAL

	<i>Credits</i>			
ALS 103 Introductory Topics in ALS	1	BO 421 Plant Physiology or		
		BO (ZO) 414 Cell Biology or		
<i>Languages (12 Credits)</i>		ZO 421 Principles of Physiology	3 4	
ENG 111 Composition and Rhetoric	3	BS 100 General Biology	4	
ENG 112 Composition and Reading	3	BS 490 Senior Seminar	1	
Foreign Language	6	BS 492 External Learning Experience or		
		BS 493 Special Problems in Biological Science or		
<i>Humanities and Social Sciences</i>		ALS 499 Honors Research/Teaching II	3 4	
<i>(21 Credits)</i>		GN 411 Principles of Genetics	4	
Humanities Electives (Area I)	6	GN 412 Elementary Genetics Lab	1	
Social Science Electives (Area II)	6	MB 401 General Microbiology	4	
Humanities, Social Science or		ZO 201 General Zoology or		
Supplemental Group D courses (Area III)	9	ZO 303 + ZO 304 Vertebrate Zoology and Lab or		
(Curriculum must include one course in literature.)		ZO 402 + ZO 403 Invertebrate Zoology and Lab ..	4	
		BO (ZO) 360 General Ecology	3	
<i>Biological Sciences</i>		BO (ZO) 365 Ecology Lab	1	
<i>(36-38 Credits)</i>		<i>Note: Students electing ZO 421 or BO (ZO) 414</i>		
BCH 451 Elementary Biochemistry	3	<i>must also elect either ZO 105 Cellular</i>		
BO 200 Plant Life or		<i>and Animal Physiology Laboratory or</i>		
BO 400 Plant Diversity	4	<i>BCH 452 Introductory Biochemistry</i>		
		<i>Laboratory</i>		2

Physical Sciences and Mathematics
(24-36 Credits)

CH 101	General Chemistry I	3
CH 121	General Chemistry I Lab	1
CH 107	Principles of Chemistry	3
CH 127	Principles of Chemistry Lab	1
CH 221, 223	Organic Chemistry I and II	8
MA 131, 231	Analytic Geometry and Calculus A, B and	
BAE 221	Agricultural Systems I: Microcomputer Applications or	
CSC 200	Intro. to Computers and Their Uses or	
ST 311	Intro. to Statistics	10
	OR	
MA 141, 241, 242	Analytic Geometry and Calculus I, II and III	12

PY 211, 212	College Physics I, II or	
PY 205, PY 208	Physics for Engineers and Scientists	8

Physical Education and Electives
(23-26 Credits)

Restricted Electives from Groups A,B,C and D	7 10
Free Electives	12
PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Minimum Hours Required for Graduation	130

NUTRITION CONCENTRATION

The nutrition concentration follows the general curricular requirements for the biological sciences program, except that students must take four courses in nutrition: FS 400, NTR 415, NTR 490, and NTR 516.

MINOR IN NUTRITION

The minor in nutrition will provide knowledge of the principles of nutrition that are needed to formulate balanced diets and to evaluate information and policies concerning foods and dietary practices. Students may select courses to emphasize human or animal nutrition or a combination of these. For additional information consult Nutrition Program 220B Polk (515-2763).

MINOR IN BIOLOGY

The minor in Biological Sciences is open to all interested baccalaureate students with the exception of Zoology and Botany majors, but is intended primarily to enhance the programs of students whose major field is outside the Biological Sciences area. Students pursuing a minor in Biological Sciences will become familiar with fundamental principles of biology and gain a broad-based perspective of the biological sciences. The minor requires a minimum of 17 credit hours. The minor program is flexible so that students may take courses in areas of individual interest.

BOTANY

Gardner Hall (Room 2214)

Professor E. D. Seneca, Head of Department

Professor C. G. Van Dyke, Undergraduate and Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

University Research Professor: W. F. Thompson

Alumni Distinguished Undergraduate Associate Professor: R. L. Beckmann

Professors: C. E. Anderson, U. Blum, R. J. Downs, R. C. Fites, J. W. Hardin, W. W. Heck (USDA), R. L. Mott, H. E. Pattee (USDA), J. P. Thomas, J. R. Troyer, T. R. Wentworth, A. M. Witherspoon; Professors Emeriti: D. B. Anderson, C. R. Noggle, H. T. Scofield, L. A. Whitford; Associate Professors: W. F. Boss, J. M. Burkholder, J. M. Stucky; Assistant Professor: R. S. Boston, J. E. Mickle, D. Robertson; Teaching Technician: D. S. Wright; Associate Members of the Faculty: H. V. Amerson (Forestry), K. O. Burke, S. C. Huber, T. W. Ruffy, Jr., H. Seltmann (USDA Crop Science), L. B. Crowder (Zoology, Biomathematics), M. M. Goodman (Crop Science, Statistics, Genetics), D. E. Moreland (Crop Science, Forestry, Toxicology), E. C. Sisler (Biochemistry).

The instructional program provides classroom, laboratory, and field experience in the major areas of plant science. Undergraduates majoring in botany are given a broad background in the humanities and physical sciences and are encouraged to participate in

independent study in the senior year. Majors, as preprofessionals in the plant sciences, are prepared for advanced study in botany and other biological fields, as well as in the applied plant sciences such as horticulture, crop science, plant pathology, resource management and environmental biology.

OPPORTUNITIES

The undergraduate degree is an excellent preprofessional degree in the plant sciences. Many majors continue with graduate studies; see list of graduate degrees. After obtaining a graduate degree, the undergraduate major will be qualified for teaching positions in community and junior colleges, colleges and universities, for research positions in federal and state government laboratories and in private industry.

Research technician positions in many life science areas in governmental and industrial laboratories are also career possibilities. The field of biotechnology provides additional technical opportunities. Field botanists and naturalists find employment in state and national park systems and nature interpretation programs.

CURRICULUM IN BOTANY

The Bachelor of Science degree with a major in botany is offered under the science curriculum of the College of Agriculture and Life Sciences. (See the freshman year program and other basic requirements.)

The Bachelor of Science degree with a double concentration—one in economics, English, history, philosophy or political science, and another in botany—is available in the College of Humanities and Social Sciences. For details, refer to the section on “College of Humanities and Social Sciences,” in this catalog.

SCIENCE PROGRAM

	<i>Credits</i>		
ALS 103 Introductory Topics in ALS	1	BAE 221 Agri. Systems Computer Applic. or	
		BAE 241 Computer Applic. in Agri. and Life	
		Science	3
		GN 412 Elementary Genetics Laboratory	1
		MB 401 General Microbiology	4
		SSC 200 Soil Science	4
		ST 311 Introduction to Statistics	3
		Three credit hours of 200 level or above course	
		with the following abbreviations CS, FS, HS and	
		PP or FW(ZO)221 or FW(ZO)353	3
		<i>Departmental Requirements and Electives</i>	
		(28 Credits)	
		BO 200 Plant Life	4
		BO (ZO) 360 Introduction to Ecology	3
		BO (ZO) 365 Ecology Lab	1
		BO 400 Plant Diversity	4
		BO 403 Systematic Botany	4
		BO 413 Introductory Plant Anatomy	4
		BO 421 Plant Physiology	4
		GN 411 The Principles of Genetics	4
		<i>Physical Education and Free Electives</i>	
		(16 Credits)	
		PE 100 Health & Physical Fitness	1
		Physical Education Electives	3
		Free Electives	12
		Minimum Hours Required for Graduation ...	131 [†]
BS 100 General Biology	4		
CH 101 General Chemistry I	3		
CH 121 General Chemistry Laboratory	1		
CH 107 Principles of Chemistry	3		
CH 127 Principles of Chemistry laboratory	1		
MA 111 Precalculus Algebra and			
Trigonometry	3		
MA 131 Analytic Geometry and Calculus A ¹	4		
PY 211, 212 College Physics I, II	8		
ZO 201 General Zoology or			
ZO 303 + 304 Vertebrate Zoology and Lab or			
ZO 402 + 403 Invertebrate Zoology and lab	4		
		<i>Restricted Electives from Groups A and C</i>	
		(22 Credits)	
CH 220 Introductory Organic Chemistry ¹	4		
CSC 200 Intro. to Computers and Use or			

[†]The proposed program meets the minimum requirements for graduate work; however, additional courses are encouraged in mathematical and physical sciences for students who are planning advanced study. See adviser.

²Completion of one course in literature is required.

MINOR IN BOTANY

The 15 credit minor in Botany is offered to any undergraduate degree student interested in gaining a basic knowledge of plants. It is intended both to complement other curricula that are related to the plant sciences and to give students a basic appreciation of plants. Such appreciation includes an understanding of plant-human interactions, plant structure and how plants function, plant identification, and the pervasive roles of plants and plant products in human society. It is not intended to prepare students for a professional career in Botany, and additional courses are recommended for students who plan graduate work in the plant sciences.

CROP SCIENCE

Williams Hall (Room 2205)

Professor W. K. Collins, Acting Head of the Department

Professor G. A. Sullivan, Acting Specialist In Charge

Professor J. M. DiPaola, Undergraduate and Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Distinguished University Professor M. M. Goodman

Alumni Distinguished Undergraduate Professors W. T. Fike, Jr., R. P. Patterson

William Neal Reynolds Professors M. M. Goodman, E. A. Wernsman

Philip Morris Professors W. K. Collins, G. F. Peedin

*Professors: J. R. Anderson, D. T. Bowman, J. C. Burns (USDA), J. W. Burton (USDA), B. E. Caldwell, H. D. Coble, F. T. Corbin, E. J. Dunphy, J. T. Green, Jr., S. C. Huber (USDA), R. E. Jarrett, W. M. Lewis, R. C. Long, J. E. Miller (USDA), D. E. Moreland (USDA), J. P. Mueller, H. Seltmann (USDA), H. T. Stalker, D. H. Timothy, J. B. Weber, W. W. Weeks, R. F. Wilson (USDA), A. D. Worsham, J. C. Wynne, A. C. York, *Adjunct Professors: D. G. Oblinger, D. T. Patterson, G. M. Werner; Professors Emeriti: R. R. Bennett, C. T. Blake, C. A. Brim, D. S. Chamberlee, J. F. Chaplin, W. A. Cope, S. H. Dobson, D. A. Emery, D. U. Gerstel, W. B. Gilbert, W. C. Gregory, H. D. Gross, G. R. Gwynn, P. H. Harvey, S. N. Hawks, G. L. Jones (†), C. Klingman, J. A. Lee, R. L. Lovvorn, R. P. Moore, A. Perry, J. L. Phillips, J. C. Rice, D. L. Thompson, J. A. Weybrea, *Associate Professors: A. H. Bruneau, K. O. Burke (USDA), T. E. Carter (USDA), D. A. Daneshmand, E. L. Fiscus (USDA), D. S. Fisher (USDA), T. G. Iselb, R. D. Keys, P. Kwanyuen, H. M. Lanker, J. P. Murphy, C. H. Peacock, S. M. Reed (USDA), R. C. Ruffy, T. W. Ruffy, Jr. (USDA), V. A. Sisson (USDA), W. D. Smith, G. G. Wilkerson; *Adjunct Associate Professor: P. S. Zarnar; Associate Professors Emeriti: R. L. Davis, W. G. Toomey; Assistant Professors: R. E. Dewey, K. L. Edmisten, G. P. Fenner, J. M. Ferguson, S. H. Kay, M. G. Redinbaugh (USDA), P. H. Sisco (USDA), A. K. Weissinger, R. Wells, R. H. White; *Associate Members of the Faculty: S. M. Schneider (Biomathematics, Plant Pathology), C. W. Stuber (Genetics), C. T. Young (Food Science), Extension Specialists: D. W. Daniel, G. E. Martin, C. M. Sasser, F. H. Yelverton*****

Crop scientists seek to improve the productivity, profitability and quality of our major food, feed, and fiber crops; enhance the quality of our turf and vegetable cover, and improve the nutrient and economic health of our world. The Crop Science four-year undergraduate program is offered within the Agronomy curriculum and administered jointly by the Crop Science and Soil Science departments. Students may earn a Bachelor of Science degree under the technology curriculum with a major in Agronomy. (See Agronomy curriculum.)

CAREER OPPORTUNITIES

Agronomy major graduates find employment as consultants, extension agents, farm managers, golf course superintendents, landscape specialists, research scientists, seed production specialists, sod production specialists, soil survey specialists, soil conservationists, technical sales representatives, and waste management specialists. The Agronomy curriculum can also be found in this catalog under "College of Agriculture and Life Sciences." (For Crop Science graduate programs, see the *Graduate Catalog*.)

UNDERGRADUATE CURRICULA

Students may earn a Bachelor of Science degree under the technology curriculum with a major in agronomy. The agronomy option is administered jointly by the Departments of Crop Science and Soil Science. See agronomy curriculum.

DAIRY SCIENCE

(See Animal Science.)

ENTOMOLOGY

Gardner Hall (Room 2301)

Professor J. D. Harper, Head

Professor P. S. Southern, Extension Specialist In Charge

Professor J. R. Meyer, Undergraduate Coordinator

Professor W. M. Brooks, Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Alumni Distinguished Undergraduate Professor C. G. Wright

Philip Morris Professor J. W. Van Duyn

William Neal Reynolds Professor G. G. Kennedy

Blanton J. Whitmire Professor C. Schal

Professors J. T. Ambrose, C. S. Apperson, R. A. Axzell, J. S. Bacher, J. R. Bradley, Jr., F. L. Gould, F. P. Han, R. J. Kuhar, G. C. Rock, K. A. Sorensen, R. E. Sumner, Adjunct Professors, C. Y. Kawashiro, P. M. Marsh, Professors Emeriti, W. V. Campbell, M. H. Farner, G. D. Jones, K. L. Knight, W. J. Mistrze Jr., H. B. Moore, H. H. Neunzig, R. L. Rabb, R. I. Robertson, C. F. Smith, Associate Professors, J. J. Arends, R. L. Brandenburg, L. L. Deitz, D. M. Jackson (USDA), E. P. Lampert, B. M. Parker, R. M. Roe, J. F. Walgenbach, Associate Professor Emeritus, R. C. Hennigan, Assistant Professors, M. E. Barbercheck, D. W. Keever (USDA), Adjunct Assistant Professors, R. C. McDaniel, C. Nalepa, Extension Specialists, S. B. Bambara, D. L. Stephan, S. M. Stringham, S. J. Toth, M. G. Walbygel, Alumni Members of the Department, W. C. Dauterman (Toxicology), H. M. Linker (Crop Science)

Undergraduate instruction in entomology is designed to provide introductory and advanced courses in the basic science of entomology and on the management of beneficial and pest insects. These courses serve students majoring in biological sciences, agronomy, horticultural science, agricultural education, and forestry. They also provide fundamental training for graduate study in entomology (see listing of graduate degrees).

OPPORTUNITIES

For graduates with advanced degrees in entomology, opportunities include research, teaching, and extension positions in colleges and universities; research, development, production, control, and sales positions in private industries; consultative positions in pest management; curatorial positions in museums; and research and regulatory positions with state and federal agencies.

UNDERGRADUATE CURRICULUM

There is no entomology undergraduate major. Those students with a primary interest in entomology are advised to take the general biological sciences curriculum and the minor in entomology.

MINOR IN ENTOMOLOGY

The academic minor in Entomology is designed for students interested in insects, their management, and their role in the functioning of natural and agricultural ecosystems. The program requires 15 semester hours. Students must take General Entomology (ENT 425) and 12 additional hours of elective courses. Six of these hours must be additional Entomology courses, of which at least 3 hours must be at the 500 level.

FISHERIES AND WILDLIFE SCIENCES

110 Brooks Avenue

Professor R. L. Noble, Undergraduate Coordinator

(See curriculum in Fisheries and Wildlife Sciences under Department of Zoology.)

FOOD SCIENCE

Schaub Food Science Building (Room 100)

Professor D. R. Lineback, Head of the Department

Associate Professor D. R. Ward, Extension Specialist in Charge

Associate Professor P. M. Foegeding, Undergraduate Coordinator

Associate Professor D. K. Larick, Graduate Coordinator

TEACHING, RESEARCH, AND EXTENSION

William Neal Reynolds Professors: T. R. Klaehammer, H. E. Swaisgood

Professors: R. E. Carawan, D. E. Carroll Jr., G. L. Catignani, Jr., H. P. Fleming (USDA) D. D. Hamann, A. P. Hansen, T. C. Lanier, R. F. McFeeters (USDA) J. L. Oblinger, T. H. Sanders (USDA), B. W. Sheldon, K. R. Swartzel, L. G. Turner, W. M. Walter, Jr. (USDA), C. T. Young; *Adjunct Professors:* J. P. Adams, N. B. Webb; *Professors Emeriti:* L. W. Aurand, H. R. Ball, T. A. Bell, Jr., T. N. Blumer, J. A. Christian, E. S. Cofer, H. B. Craig, M. E. Gregory, M. W. Hoover, I. D. Jones, V. A. Jones, N. C. Miller, Jr., A. E. Purcell, W. M. Roberts, M. L. Speck, F. R. Tarver, Jr., F. B. Thomas, F. G. Warren; *Associate Professors:* L. C. Boyd, E. A. Foegeding, D. H. Pilkington, J. F. Rushing, S. J. Schwartz; *Assistant Professors:* J. C. Allen, P. A. Curtis; *Extension Specialist:* D. P. Green; *Associate Members of Faculty:* B. K. Garland (Home Economics), H. M. Hassan (Biochemistry, Microbiology, Toxicology); H. R. Horton (Biochemistry), F. T. Jones (Poultry Science), C. J. Lackey (Foods and Nutrition), H. E. Pattee (Botany).

The Department of Food Science provides undergraduate and graduate programs for the application and integration of chemistry, biology, and engineering to the development, processing, packaging, quality control, distribution and utilization of foods. The department maintains modern fully equipped laboratories for teaching and research in the disciplines of food microbiology, food chemistry/biochemistry, food engineering, and nutrition; and the product areas of dairy, fruit, meats, poultry, seafood, and vegetable products.

OPPORTUNITIES

Increasing consumer demands for greater varieties of nutritious and convenience foods of uniformly high quality create many varied career opportunities in the food and allied industries.

Career opportunities in food industries are: management, research and development, process supervision, quality control, procurement, distribution, sales and merchandising. Positions include sales and services in allied industries, consulting and trade association activities and promotional and educational services.

Food Science graduates hold teaching, research and extension positions with colleges and universities. Governmental agencies employ food scientists whose work is directed toward research, regulatory control and the development of food standards.

The food industry provides both merit and financial need scholarships to encourage students preparing for careers in Food Science. Phi Tau Sigma Society invites outstanding seniors to membership, and all students are encouraged to participate in the Food Science Club, a student branch of the Institute of Food Technologists.

CURRICULA IN FOOD SCIENCE

The Bachelor of Science degree with a major in Food Science is offered through curricula with a science emphasis or a technology emphasis. The science program is designed for students with interest in graduate school or for those desiring more rigorous science courses for technical careers in the food industry. Students more interested in business opportunities for technically trained individuals find the technology program permits greater flexibility in complementing Food Science coursework with business and agricultural commodity courses.

(See listing of graduate degrees offered.)

SCIENCE PROGRAM

	<i>Credits</i>		<i>Physics (8 Credits)</i>
ALS 103 Introductory Topics in ALS	1	PY 211 College Physics I	4
		PY 212 College Physics II	4
			<i>Food Science (31 Credits)</i>
		FS 201 Food Science and the Consumer	3
		FS 331 Food Engineering	3
		FS 400 Principles of Human Nutrition	3
		FS 402 Food Chemistry	3
		FS 403 Food Analysis	3
		FS (MB) 405 Food Microbiology	3
		FS 421 Food Preservation	3
		FS (ANS,PO) 322 Muscle Foods and Eggs or	
		FS (ANS) 324 Milk and Dairy Products or	
		FS 423 Muscle Food Technology or	
		FS 425 Processing Dairy Products	3
		FS 490 Food Science Seminar	1
		Food Science Electives	6
			<i>Physical Education and Free Electives</i>
			<i>(17 Credits)</i>
		PE 100 Health and Physical Fitness	1
		Physical Education Electives	3
		Free Electives	13
		Minimum Hours Required for Graduation	130

¹Any English, foreign language or communication course may be used as language elective. A literature course or 200 level foreign language course must be included in the curriculum.

TECHNOLOGY PROGRAM

	<i>Credits</i>		<i>Mathematics (10 Credits)</i>
ALS 103 Introductory Topics in ALS	1	MA 111 Precalculus Algebra and Trigonometry	3
		MA 121 Elements of Calculus or	
		MA 131 Analytic Geometry and Calculus A	4
		MA 114 Introduction to Finite Math Appl. or	
		MA 231 Analytic Geometry and Calculus B	3
			<i>Chemistry (12 In Credits)</i>
		CH 101 General Chemistry I	3
		CH 121 General Chemistry Laboratory	1
		CH 107 Principles of Chemistry	3
		CH 127 Principles of Chemistry Laboratory	1
		CH 220 Introduction to Organic Chemistry or	
		CH 221 Organic Chemistry I and	
		CH 223 Organic Chemistry II	4

<i>Biological Sciences (8 Credits)</i>		FS (MB) 405 Food Microbiology	3
BS 100 General Biology	4	FS 416 Quality Control of Food Products	3
MB 401 General Microbiology	4	FS 421 Food Preservation	3
<i>Physics (5-8 Credits)</i>		FS (ANS, PO) 322 Muscle Foods and Eggs or	
PY 221 College Physics or		FS (ANS) 324 Milk and Dairy Products or	
PY 211 College Physics I and		FS 423 Muscle Food Technology or	
PY 212 College Physics II	5-8	FS 425 Processing Dairy Products	3
<i>Groups A,B,C Electives (10-17 Credits)</i>		FS 490 Food Science Seminar	1
Electives	10-17	Food Science Elective	2
<i>Food Science (27 Credits)</i>		<i>Physical Education and Free Electives (17 Credits)</i>	
FS 201 Food Science and the Consumer	3	PE 100 Health and Physical Fitness	1
FS 331 Food Engineering	3	Physical Education Electives	3
FS 402 Food Chemistry	3	Free Electives	13
FS 403 Food Analysis	3	Minimum Hours Required for Graduation	130

¹Dependent on whether CH 220 or CH 221-223 and PY 221-212 are elected.

MINOR IN FOOD SCIENCE

The minor in Food Science is designed to provide important food science principles and concepts to students seeking to improve their understanding of food and its manufacture and, especially, to those seeking employment as chemists, microbiologists, engineers, nutritionists, business specialists, or technical writers in the food and pharmaceutical industry. One introductory course (FS 201) is required, and 12 additional hours at the 300 or 400 level may be selected to complement a variety of majors.

GENETICS

Gardner Hall (Room 3513)

Professor D. F. Matzinger, Department Head and Graduate Coordinator

Professor W. H. McKenzie, Undergraduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Distinguished University Professor and William Neal Reynolds Professor: C. S. Levings

Distinguished University Professor: J. G. Scandalios

Alumni Distinguished Undergraduate Professor: W. H. McKenzie

Professors: W. R. Atchley, W. E. Kloos, R. H. Moll, G. Namkoong (USFS), S. L. Spiker, C. W. Stuber (USDA); Adjunct Professor: M. D. Chilton; Professors Emeriti: C. H. Bostian, W. D. Hanson, T. J. Mann, L. E. Mettler, A. C. Triantaphyllou; Associate Professors: M. A. Conkling, S. E. Curtis, T. H. Emigh, T. F. C. Mackay; Assistant Professors: M. T. Andrews, J. W. Mahaffey; Associate Members of the Faculty: H. E. Schaffer (Academic Computing), E. J. Eisen, C. L. Markert, B. T. McDaniel, R. M. Patters, O. W. Robison (Animal Science); R. S. Boston, W. F. Thompson (Botany); E. A. Wernsman (Crop Science); M. M. Goodman (Crop Science, Statistics, Botany); D. H. Timothy (Crop Science); J. O. Rawlings, B. S. Weir (Statistics); R. R. Sederoff (Biochemistry, Forestry) K 4; Tatchell (Microbiology).

The Genetics faculty offers instruction at advanced undergraduate and graduate levels. The undergraduate courses are designed to support other departments, giving students a background in genetics. Since there is no genetics baccalaureate program, interested undergraduates are encouraged to pursue a biological sciences program. The graduate program is designed to train scientists for research and teaching careers in basic genetics and in its application plant and animal breeding. (See listing of graduate degrees offered.)

MINOR IN GENETICS

The Department of Genetics offers an undergraduate Minor in Genetics to provide students with strong preparation in the principles of Genetics and Molecular Biology as well as preparation in ancillary fields such as Statistics, Biochemistry and Microbiology.

This minor is appropriate for (but not limited to) students with majors in Animal Science, Biochemistry, Biological Sciences, Botany, Crop Science, Conservation, Entomology, Fisheries and Wildlife Sciences, Forestry, Horticultural Science, Microbiology, Pest Management, Poultry Science, and Zoology. The Genetics minor requires 17-18 credit hours; 14-15 specified and 3 elective. A grade of C or better is required for all courses to fulfill the Genetics minor requirements.

HORTICULTURAL SCIENCE

Kilgore Hall (Room 114)

Professor T. J. Munaco, Head of the Department

Professor K. B. Perry, Extension Specialist In Charge

Lecturer B. H. Lane, Undergraduate Coordinator

Professor D. J. Werner, Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Alumni Distinguished Undergraduate Professor: B. H. Lane

Professors: J. R. Balington Jr. (T. E. Bulderback, F. A. Blazich, W. W. Collins, A. A. De Hertogh, P. R. Fantz, R. G. Gardner, W. R. Henderson, L. E. Hinesley, R. A. Larson, C. M. Mauland, P. V. Nelson, M. A. Powell, Jr., D. M. Pharr, J. C. Raulston, D. C. Sanders, W. A. Skroch, C. R. Unrath, T. C. Wehner, J. H. Wilson Jr., L. G. Wilson, E. Young, A. J. et al. Professors: D. T. Patterson (Duke University); Professors Emeriti: W. E. Ballinger, A. A. Banadya, J. F. Brooks Jr., F. D. Cochran, H. M. Covington, J. H. Harris, F. L. Haynes Jr., G. R. Hughes, J. M. Jenkins, M. H. Kolbe, T. R. Konsler, J. W. Love, C. H. Miller, D. T. Pope, Associate Professors: D. A. Bailey, S. M. Blankenship, W. C. Fonteno, W. E. Hooker, D. W. Monks, M. M. Peet, E. B. Poling, S. L. Warren, Adjunct/Associate Professors: D. R. Carlson (HASF), et al.; P. S. Zorner (Mycogen Corp.); Associate Professors Emeriti: T. F. Cannon, W. W. Reid, D. C. Zeiger, Assistant Professors: J. D. Burton, J. M. Davis, M. L. Parker, T. G. Ranney, J. R. Schultheis, Lecturer: M. E. Traer, Affiliated Specialists: L. Bass, R. E. Burr, Associate Members of the Faculty: D. E. Carroll, Jr. (Food Science), R. J. Downs, R. L. Mott (Botany), R. H. Mott (Genetics), R. J. Valk (Soil Science)

Horticulture is a dynamic segment of agriculture. The development, growth, distribution, and utilization of fruits, vegetables, flowers and ornamental plants plus the arts of floral design and landscaping enrich our lives with nutritious foods and more attractive surroundings. North Carolina's varied climatic conditions favor the production of a wide variety of horticultural crops on a commercial scale as well as the development of parks and gardens. The population and amount of industry in the state are increasing, and with them the use of ornamental plants. Designers skilled in residential and commercial landscaping, interior plantscaping, and plant maintenance are in demand. All this in turn has created a growth in interest in horticulture education.

Undergraduate programs in horticultural science offer a broad based education in physical and biological sciences and a sound cultural background. Students can concentrate in areas of fruit and vegetable science, floriculture, woody ornamental plant science, landscape horticulture, or pursue a general approach which encompasses all the specialties. They are prepared for graduate study or for diverse professional service.

OPPORTUNITIES

Horticulture graduates fill positions in production, processing, sales and service. Among these are county extension agents; vocational agricultural teachers; landscapers and landscape contractors; farm operators; orchard, nursery, greenhouse and flower shop managers; research, production and promotional specialists with commercial seed, floral, fertilizer, chemical and food companies; inspectors and quality control technologists; USDA specialists and as leaders in other phases of agricultural and industrial developments. The student may also prepare for a career in research, teaching, extension, etc. in horticulture.

CURRICULA IN HORTICULTURAL SCIENCE

The degree of Bachelor of Science with a major in horticultural science can be earned in either science or technology—offered by the College of Agriculture and Life Sciences. Under the science curriculum, specialized education is offered in fruit and vegetable crops, floriculture, and ornamental horticulture. Under the technology curriculum, education is offered in landscape horticulture, or in a general approach which includes all the commodity areas.

SCIENCE PROGRAM

	<i>Credits</i>
ALS 103 Introductory Topics in ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
COM 110 Public Speaking	3
Literature Elective/Foreign Language	3
<i>Humanities and Social Sciences Group D (21 Credits)</i>	
Electives (Incl. ARE 212)	21
<i>Physical and Biological Sciences (28 Credits)</i>	
BO 200 Plant Life	4
BS 100 General Biology	4
CH 101 General Chemistry	3
CH 121 General Chemistry Laboratory	1
CH 107 Principles of Chemistry	3
CH 127 Principles of Chemistry Laboratory	1
MA 111 Precalculus Algebra and Trigonometry	3
MA 121 Elements of Calculus or	
MA 131 Analytic Geometry & Calc. A	4
PY 221 College Physics	5
<i>Physical Education and Free Electives (16 Credits)</i>	
PE 100 Health & Physical Fitness	1
Physical Education Electives	3
Free Electives	12

TECHNOLOGY PROGRAM

	<i>Credits</i>
ALS 103 Introductory Topics in ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
COM 110 Public Speaking	3
Literature Elective	3
<i>Humanities and Social Sciences Group D (21 Credits)</i>	
Electives (Incl. ARE 212 LH)	21
<i>Physical and Biological Sciences (31-32 Credits)</i>	
BO 200 Plant Life	4
BS 100 General Biology	4
CH 101 General Chemistry I	3
CH 121 General Chemistry I Laboratory	1
CH 107 Principles of Chemistry	3
CH 127 Principles of Chemistry Laboratory	1
MA 111 Precalculus Algebra and Trigonometry ...	3
MA 114 Intro. to Finite Math. Appl. or	
MA 121 Elements of Calculus or	

<i>Group A and C Courses (26 Credits)</i>	
BCH 451 Introductory Biochemistry	3
BO 421 Plant Physiology	4
CH 221, 223 Organic Chemistry I, II	8
ENT 425 General Entomology	3
PP 315 Principles of Plant Pathology	4
SSC 200 Soil Sciences	4

FV—Fruits and Vegetables, OH—Ornamentals, FL
Floriculture

<i>Department Requirements and Electives (26 Credits)</i>	
GN 411 The Principles of Genetics	4
GN 412 Genetics Lab	1
HS 201 Principles of Horticulture	3
HS 211 Ornamental Plants I (OH)	3
HS 212 Ornamental Plants II (OH, FL)	3
HS 301 Plant Propagation (OH, FL)	4
HS 411 Nursery Management (OH)	3
HS 421 Tree Fruit Production (FV)	3
HS 422 Small Fruit Production (FV)	3
HS 431 Vegetable Production (FV)	4
HS 440 Greenhouse Management (FL)	3
HS 441 Floriculture I (FL)	3
HS 442 Floriculture II (FL)	3
HS 471 Tree and Grounds Maintenance (OH)	4
HS 490 Hort. Science Seminar	1
HS (FS) 462 Post Harvest Physiology (FV)	3
Departmental Elective (FV-4) (FL-1)	variable
Minimum Hours Required for Graduation ...	130

MA 131 Analytic Geometry & Calc. A	3-4
PY 221 College Physics	5
SSC 200 Soil Science	4

<i>Physical Education and Free Electives (16-17 Credits)</i>	
PE 100 Health & Physical Fitness	1
Physical Education Electives	3
Free Electives	12-13

<i>Group A and C Courses (21 Credits)</i>	
BO 421 Plant Physiology	4
ENT 425 General Entomology	3
HS 201 Principles of Horticulture (LH)	3
HS 301 Plant Propagation (HG)	4
HS 411 Nursery Management	3
HS 440 Greenhouse Management (HG)	3
HS 471 Tree & Grounds Maintenance (LH)	4
PP 315 Plant Diseases	4

*Departmental Requirements and Electives**
(27-34 Credits)

GN 301	Genetics in Human Affairs or	HS (FS) 462	Postharvest Physiology (HG)	3
GN 411	Principles of Genetics (HG)	LAR 234	Intro to Environmental Design (LH) ..	3
HS 211	Ornamental Plants (LH) (HG) or	LAR 400	Intermed. Landscape Arch.	
HS 212	Ornamental Plants II (LH)	<i>Desg. (LH)</i>	6	
HS 342	Landscape Horticulture (LH)	LAR 430	Site Planning (LH)	3
HS 400	Residential Landscape (LH)	LAR 457	Landscape Mat'l's. & Construct. I (LH) ..	3
HS 416	Princ. Ornamental Plant Design or	Select one 3 cr. course from the following: (HG) ..	3	
DN 433	Native Plants in Environ. Design (LH) ..	HS 211	Ornamental Plants I	
HS 421	Tree Fruit Production (HG) or	HS 212	Ornamental Plants II	
HS 422	Small Fruit Production (HG)	HS 342	Landscape Horticulture	
HS 431	Vegetable Production (HG)	HS 371	Interior Plantscapes	
HS 442	Floriculture II (HG)	HS 421	Tree Fruit Production	
HS 471	Tree and Grounds Maintenance (HG) ..	HS 422	Small Fruit Production	
HS 490	Horticultural Science Seminar	HS 441	Floriculture I	
		HS 531	Physiology of Landscape Plants	
		Minimum Hours required for Graduation	130*	

*General Horticulture HG; Landscape Horticulture LH.

*Hours Required for Graduation in LH are 137.

MINOR IN HORTICULTURAL SCIENCE

The academic minor in Horticultural Science is offered to students who desire a strong foundation in the principles of horticultural science. Students may choose to enhance their own major by selecting courses in a specialized area of horticulture such as fruits and vegetables, ornamentals, floriculture, or landscape horticulture, or they may pursue a more general approach to the entire field of study.

MEDICAL TECHNOLOGY

Gardner Hall (Room 1627)

Professor G. C. Miller, Undergraduate Coordinator

(See Science Program in Medical Technology under Department of Zoology.)

MICROBIOLOGY

Gardner Hall (Room 4515)

Professor L. W. Parks, Head of the Department

Alumni Distinguished Undergraduate Associate Professor: G. H. Luginbuhl, Undergraduate Coordinator

Associate Professor K. G. Tatchell, Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Professors: P. E. Bishop (USDA), W. J. Dubrogosz, G. H. Elkan, J. J. Perry; Adjunct Professors: C. R. Bunn, I. A. Casas, R. E. Kanich, S. R. Tove; Associate Professors: J. M. Mackenzie, T. Melton, E. S. Miller, K. G. Tatchell; Adjunct Associate Professor: K. T. Kleeman; Assistant Professors: S. M. Laster, I. T. D. Petty; Adjunct Assistant Professors: W. S. Dallas, S. H. Shore; Teaching Technicians: V. M. Knowlton, C. S. Richter; Lab Supervisor: T. J. Schneeweis; Associate Members of the Faculty: P. M. Foegeding (Food Science), F. J. Fuller (Veterinary Medicine), P. B. Hamilton (Poultry Science), H. M. Hassan (Biochemistry), T. R. Kraenhammer (Food Science), W. E. Kloos (Genetics), J. G. Lecce (Animal Science).

The microbiology program provides basic preparation in microbiology and immunology for professional microbiologists and students in other sciences, and an awareness of the microbial world as it relates to our daily lives for non-science majors. Microbiology is concerned with the growth and development, physiology, classification, ecology, genetics and other aspects of the life processes of an array of microscopic, generally single-celled, organisms and viruses. These organisms frequently serve as model systems for elucidation

of fundamental processes that are common to all living cells. Most of the major discoveries that have produced the spectacular advances in biology during the past decade have resulted from studies of microbial systems. Future developments in biotechnology, production of food and fuel, and human and animal health, will rely heavily on understanding microbial processes.

OPPORTUNITIES

Microbiologists are employed in university, governmental and industrial research laboratories, diagnostic and quality control laboratories, teaching, and technical sales and service positions.

MICROBIOLOGY CURRICULUM

The microbiology curriculum leading to a Bachelor of Science degree, is designed to provide the student with a strong foundation in mathematics, chemistry, and physics, and skills in oral and written communication. The student will also gain broad general knowledge of molecular and cellular biology as well as a foundation in the basic areas of microbiology and immunology. Graduates of this curriculum will be prepared for work in research laboratories and production facilities or for further study in graduate or professional schools.

MICROBIOLOGY CURRICULUM

	<i>Credits</i>		
ALS 103 Intro. Topics ALS	1	GN 412 Elem. Genetics Lab	1
<i>Languages (12 Credits)</i>		BCH 451 Elem. Biochemistry	3
ENG 111 Composition and Rhetoric	3	BCH 452 Biochemistry Lab	2
ENG 112 Composition and Rhetoric	3	ZO 805 Cell & Physiology Lab	2
ENG 333 Comm. Sci. & Research	3	BO (ZO) 414 Cell Biology or	
Communication Elective	3	ZO 421 Principle of Physiology or	
		BO 421 Plant Physiology	3-4
<i>Mathematics, Statistics (10 Credits)</i>			
MA 131 Anly. Geom. & Calc.	4	<i>Major Field of Study (12 Credits)</i>	
MA 231 Anly. Geom. & Calc B	3	<i>Required Courses</i>	
ST 311 Intro. to Statistics	3	MB 401 General Microbiology	4
<i>Humanities and Social Sciences</i>		MB 411 Medical Microbiology	4
<i>(21 Credits)</i>		MB 414/514 Metabolic Regulation	3
Literature Elective	3	MB 491 Senior Sem. in Microbiology	1
Humanities Elective	3	<i>Restricted Electives (9 Credits)</i>	
Social Science Electives	6	(at least three of the following):	
Supplemental Group D. Courses	9	MB (FS) 405 Food Microbiology	3
<i>Natural Sciences (47-48 Credits)</i>		MB 495 Special Problem in Microbiology	3
CH 101 General Chemistry	3	MB 503 Microbial Diversity	3
CH 121 General Chemistry Lab	1	MB 518 Introductory Virology	3
CH 107 Principles of Chemistry	3	MB (SSC) 532 Soil Microbiology	3
CH 127 Principles of Chemistry Lab	1	MB 551 Immunology	3
CH 221 Organic Chemistry I	4	MB 558 Prokaryotic Genetics	3
CH 223 Organic Chemistry II	4	BO (ZO) 360/365. Ecology and Lab	4
PY 211 General Physics I	4	ZO 480 Lab. Tech. Cell Biology	3
PY 212 General Physics II	4	Other Microbiology Courses	
BS 100 General Biology	4	<i>Free Electives (13-14 Credits)</i>	
ZO 205 Intro. Cell & Development Zoology	4	<i>Physical Education (4 Credits)</i>	
GN 411 Principles of Genetics	4	Minimum hours for graduation: 130	

MINOR IN MICROBIOLOGY

The Department of Microbiology offers an undergraduate minor available to all baccalaureate degree students at North Carolina State University who are not majoring in microbiology. The minor is especially appropriate for (but not limited to) students majoring in the biological or agricultural sciences, physical sciences or science education.

The minor requires 15 semester hours including 8 hours of required courses and 7 hours from a group of restricted electives. Any prerequisite courses are in addition to these courses. A grade of C or better is required for all courses taken to fulfill the minor requirements.

NATURAL RESOURCES

(Also see Forest Resources and Physical and Mathematical Sciences)

Patterson (Room 218) and Williams (Room 2321)

Professor L. A. Ihnen, Undergraduate Coordinator, Agricultural and Resource Economics

Associate Professor H. J. Kleiss, Undergraduate Coordinator, Soil Science

Wise use of all our natural resources (soil, water, air, minerals, flora, fauna and people) for the benefit of current and future members of society is the goal of natural resource management. This important challenge recognizes the interdependence of people with their environment and requires an integrated, multidisciplinary approach to solving society's resource problems. Population growth, rising incomes, life style changes and urbanization lead to more intensive use of all natural resources. These trends present challenges to resource managers who must be trained in the basic principles of several disciplines in order to develop and apply sound management strategies to our resource problems. Natural resource professionals must understand resources and the social systems governing their use. They must be able to work in teams to analyze potential effects of resource use and to design ways to make efficient use of natural and environmental resources for current and future generations.

To accommodate the breadth and complexity of natural resource management, the Bachelor of Science degree in natural resources is a campus-wide program involving three colleges and four departments that administer seven concentrations. A common core of 84 hours of coursework provides a balanced foundation in communication, humanities, social sciences, mathematics and the natural sciences. The core course requirements include a freshman orientation course and a senior level applications course that natural resource majors in all concentrations must complete. Within the College of Agriculture and Life Sciences, three concentrations are available: Economics and Management, Soil Resources and Soil and Water Systems. For information on other concentrations see Forestry and Marine, Earth and Atmospheric Sciences.

CURRICULUM IN NATURAL RESOURCES

(see special note at bottom of curriculum display)

	<i>Credits</i>	<i>Elective</i>	3
NR 100 Intro. to Natural Resources	2		
<i>Languages (12 Credits)</i>			
ENG 111 Composition and Rhetoric	3		
ENG 112 Composition and Reading	3		
ENG 331 Comm. for Engr. & Tech. or			
ENG 332 Comm. for Bus. Mgmt. or			
ENG 333 Comm. for Sci. & Res.	3		
COM 110 Public Speaking	3		
<i>Humanities and Social Sciences</i> (21 Credits)			
ARE 212 Economics of Agriculture or			
EC 201 Introduction to Economics	3		
ARE (EC) 336 Intro. Res. & Envir. Econ.	3		
PS 201 Intro. American Govt. or			
PS 202 State & Local Government	3		
History and or Literature Elective	6		
Philosophy, Religion or Fine Arts Elective	3		
		<i>Physical and Biological Sciences</i> (13 Credits)	
		BS 100 General Biology	4
		BO 200 Plant Life or	
		ZO 201 General Zoology	4
		BO (ZO) 360 Introduction to Ecology	3
		BO (ZO) 365 Ecology Laboratory	1
		CFR 134 Computers in Natural Resources	1
		CH 101 General Chemistry I	3
		CH 121 General Chemistry Lab	1
		CH 107 Principles of Chemistry	3
		CH 127 Principles of Chemistry Lab	1
		MA 131 Anly. Geometry & Calc. A	4
		MA 231 Anly. Geometry and Calc. B	3
		MEA 101 Geology I: Physical	3
		MEA 110 Geology I Laboratory	1

PY 211	College Physics I or	
PY 205	Physics for Engr. & Sci. I	4
SSC 200	Soil Science	4
ST 311	Introduction to Statistics ¹ or	
ST (BUS) 350	Econ. & Bus. Statistics ²	3
<i>Physical Education</i>		
<i>(2 Credits)</i>		
PE 100	Health and Physical Fitness	1
PE Elective		1

Concentration Requirements
(36-44 Credits)

NR 400	Management of Natural Resources	4
Minimum Hours Required for Graduation		120-128

ECONOMICS AND MANAGEMENT CONCENTRATION

ACC 220	Accounting II or	
ACC 280	Managerial Accounting	3
ARE (EC) 301	Inter. Microeconomics	3
ARE 303	Farm Management or	
BUS (EC) 310	Managerial Economics	3
ARE 306	Agricultural Law or	
ARE 495Y	Environmental Law	3
ARE 321	Agri. Financial Mgmt. or	
BUS 320	Financial Management	3
BUS 455	Quant. Methods for Mgmt. or	
EC 451	Introduction to Econometrics	3
EC 410	Public Finance	3
ARE (EC) 436	Environmental Econ.	3
MA 114	Intro. to Finite Mathematics	
	with Applications	3
Restricted Electives ³		9
		36

SOIL AND WATER SYSTEMS CONCENTRATION

BAE 323	Water Management	3
BAE 324	Introduction to Surveying	1
BAE 471	Land Resources Envir. Engr. or	
SSC 562	Envir. Applications of Soil Sci.	3
BAE 578	Agricultural Waste Mgmt. or	
CH 220	Intro. to Organic Chemistry or	
MB 200	Microbio. and World Affairs or	
FOR (MDS) 584	Practice of Envir. Impact Assessment	3-4
FOR 401	Forest Hydrology and Watershed Management	4
FOR 472	Renewable Resource Policy and Management or	
ARE 495Y	Environmental Law	3 4

Note: The curriculum display shown above is approved effective in the 1992 Fall Semester. Students entering the program as freshmen in the 1992 Fall Semester must meet the following additional requirements:

- 1) Four semesters of Physical Education required.
- 2) A literature course (either English literature or foreign language at the 200 or above) is required for graduation.
- 3) Foreign Language proficiency at the FL 102 level for graduation for freshmen entering program in the Fall 1992 semester.

MEA 200	Introduction to Oceanography	3
MEA 565	Hydrology or	
MEA 493F	Practical Hydrogeology	2-3
NR 300	Natural Res. Measurements	4
SSC 361	Role of Soils in Envir. Mgmt.	3
SSC 452	Soil Classification	4
SSC 461	Soil Phys. Properties and Plant Growth	3
ZO 419	Limnology	3
ZO 460	Aquatic Natural History Lab	2
		41-44

SOIL RESOURCES CONCENTRATION

BAE 323	Water Management	3
BAE 324	Introduction to Surveying	1
BAE 471	Land Resource Envir. Engr. or	
FOR 401	Forest Hydrogeology & Watershed Management or	
SSC 562	Envir. Applications of Soil Science	3-4
CH 220	Intro. Organic Chemistry	4
CS 312	Pasture and Forage Crops	3
FOR 353	Air Photo Interp. and Photogrammetry	3
MEA 410	Intro. to Geologic Materials or	
MB 401	General Microbiology	4
NR 300	Natural Res. Measurements	4
SSC 341	Soil Fertility and Fertilizers	3
SSC 342	Soil Fertility Laboratory	1
SSC 361	Role of Soils in Envir. Mgmt.	3
SSC 370	Alternative Agri. Systems	3
SSC 452	Soil Classification	4
SSC 461	Soil Physical Properties and Plant Growth	3
		42-43

¹BO 200 is required in the Soil Resources Conc. and the Soil and Water Systems Conc.

²ST 311 is required in the Soil Resources Concentration and Soil and Water Systems Conc.

³ST(BUS) 350 is required in the Economics and Management Concentration.

⁴BAE(SSC) 323, BO 421, CS 411, FOR 252, FOR 401, FW(ZO) 353, FW(FOR) 404, FW(ZO) 420, MEA 130, MEA 135, MEA 140, MEA(ZO) 220, MEA 300, MEA 311, MEA 313, NR 300, SSC 361, SSC 370, SSC 461, ZO 441, ZO 442.

PLANT PATHOLOGY

Gardner Hall (Room 2518)

Professor O. W. Barnett, Head of the Department

Professor R. K. Jones, Extension Specialist in Charge

Professor L. R. Grand, Undergraduate Coordinator

Professor D. M. Benson, Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Professors: C. W. Averre III, K. R. Barker, D. F. Bateman, M. K. Beute, R. I. Bruck, C. L. Campbell, J. M. Davis, H. E. Duncan, E. Echandi, A. S. Heagle (USDA), J. S. Huang, W. L. Klarman, L. T. Lucas, C. E. Main, R. D. Mühlholland, J. W. Moyer, G. A. Payne, R. A. Reinert (USDA), P. B. Shoemaker, H. W. Spurr Jr. (USDA), T. B. Sutton; *Professors Emeriti:* J. L. Apple, R. Aycock, C. N. Clayton, D. E. Ellis, G. V. Gooding, Jr., T. T. Hebert, G. B. Lucas, N. T. Powell, J. P. Ross, J. N. Sasser, D. L. Strider, H. H. Triantaphyllou, F. L. Wellman, J. C. Wells, N. N. Winstead; *Associate Professors:* J. E. Bailey, M. L. Carson (USDA), M. E. Daub, B. C. Haning, S. Leath (USDA), S. A. Lommel, T. A. Melton III, D. F. Ritchie, S. R. Shafer (USDA), H. D. Shew; *Assistant Professors:* V. J. Elliott (USDA), P. B. Lindgren, C. H. Opperman, J. B. Ristano, S. M. Schneider (USDA), R. G. Upchurch (USDA); *Adjunct Assistant Professors:* G. Hellman, J. L. Imbriani, S. Spencer; *Research Extension Specialist:* W. O. Cline; *Associate Members of the Faculty:* M. A. Conkling (Genetics), E. B. Cowling (Forestry), W. M. Hagler Jr. (Animal Science, Poultry Science), M. P. Levi (Forestry), R. C. Rufty (Crop Science), C. G. VanDyke (Botany), J. H. Wilson, Jr. (Horticulture).

Undergraduate instruction in plant pathology is designed to provide introductory and advanced courses on the nature and control of plant diseases to students majoring in crop science, horticultural science, agricultural education and forestry. It also provides fundamental training necessary for graduate study in plant pathology.

OPPORTUNITIES

Employment in research, extension and teaching is available to graduates with advanced degrees in plant pathology. Research openings are with the U. S. Department of Agriculture, state experiment stations, industry, and private consulting. The rapid development of agricultural chemicals and other methods for disease control offers numerous opportunities.

POULTRY SCIENCE

Scott Hall (Room 203)

Professor G. B. Havenstein, Head of the Department

Professor T. A. Carter, Extension Specialist In Charge

Assistant Professor S. L. Pardue, Undergraduate Coordinator

Professor T. D. Siopes, Graduate Coordinator

TEACHING, RESEARCH, AND EXTENSION

Alumni Distinguished Undergraduate Professor: C. R. Parkhurst

William Neal Reynolds Professor: W. E. Donaldson

Professors: J. T. Brake, V. L. Christensen, F. W. Edens, J. D. Garlich, W. M. Hagler, Jr., P. B. Hamilton, F. T. Jones, J. F. Ort, J. C. H. Shih; *Adjunct Professors:* R. R. Dietert, K. K. Krueger; *Professors Emeriti:* W. G. Andrews, R. E. Cook, E. W. Glazener, J. R. Harris, C. H. Hill, G. A. Martin, W. C. Mills, Jr., T. B. Morris; *Associate Professors:* M. J. Wineford; *Adjunct Associate Professors:* C. A. Ricks, J. K. Tyczkowski, C. E. Whitfill; *Assistant Professors:* K. E. Anderson, P. R. Ferket, J. N. Pettie, M. A. Qureshi, D. Y. Rives; *Adjunct Assistant Professor:* R. P. Gildersleeve; *Assistant Professor Emeritus:* J. R. West; *Extension Specialist:* G. S. Davis; *Extension Specialist Emeritus:* C. E. Brewer; *Associate Members of the Faculty:* W. J. Croom, Jr. (Animal Science), P. A. Curtis (Food Science), B. W. Sheldon (Food Science), D. P. Wages (College of Veterinary Medicine).

The Department of Poultry Science provides instruction in the principles of vertically integrated poultry production and in such related fields as nutrition, physiology, genetics, toxicology and biotechnology. Through teaching, research and extension, the department serves students, poultry producers and allied industries. Poultry production has increased rapidly during the last two decades and ranks first in North Carolina as a source of agricultural income. North Carolina ranks third nationally in the production of poultry products; the climatic and economic conditions in the state provide a sound base for continued expansion.

OPPORTUNITIES

The change from small farm operations to large commercial poultry enterprises has created more specialized positions than there are available poultry graduates. Production oriented positions and off-the-farm operations in activities such as processing and distribution offer new job opportunities. The allied industries—feed, equipment, financing, pharmaceutical and other supplies—need more employees trained in poultry science. Graduates hold positions as managers and field representatives for businesses identified with, or serving the poultry industry. Graduates are also employed in communication and public relations and as teachers and extension and research specialists. Some graduates have their own poultry businesses.

CURRICULA IN POULTRY SCIENCE

Students desiring the Bachelor of Science with a major in poultry science may choose either the science or technology curriculum offered by the Department of Poultry Science. (See listing of graduate degrees.) One may obtain a double major in certain other curricula through careful use of electives and or summer school attendance. The student should consult the undergraduate advisers in the department(s) concerned. Currently, the pre-veterinary science student may utilize all requirements toward a Bachelor of Science degree in the science option.

(See the freshman year and basic requirements for College of Agriculture and Life Sciences.)

SCIENCE PROGRAM

This curriculum is for the student interested in the basic biological and physical sciences. The student is better prepared for advanced study in various disciplines such as genetics, nutrition, physiology and pathology. Several pre-veterinary students are currently enrolled in this curriculum and are seeking a Bachelor of Science degree in poultry science. (See Pre professional Program in Veterinary Medicine).

	<i>Credits</i>		
ALS 103 Introductory Topics in ALS	1	MA 111 Precalculus Algebra & Trigonometry	3
		MA 114 Intro. to Finite Mathematics or	
		MA 121 Elements of Calculus or	
		MA 131 Anly. Geom. & Calc. A or	
		MA 141 Anly. Geom. & Calc. I	3.4
ENG 111 Composition and Rhetoric	3	MB 401 General Microbiology	4
ENG 112 Composition and Reading	3	PY 221 College Physics or	
COM 110 Public Speaking	3	PY 211 & 212 College Physics I, II	5.8
Literature Elective	3		
		<i>Humanities & Social Sciences</i>	
		(21 Credits)	
Electives	21	<i>Physical Education & Free Electives</i>	
		(17 Credits)	
		PE 100 Health & Physical Fitness	1
		Physical Education Electives	3
		Free Electives	13
		<i>Physical & Biological Sciences</i>	
		(27-31 Credits)	
BS 100 General Biology	4		
CH 101 General Chemistry	3		
CH 121 General Chemistry Laboratory	1		
CH 107 Principles of Chemistry	3		
CH 127 Principles of Chemistry Lab	1		

*Group A, B, C Courses
(22-26 Credits)*

CH 221	Organic Chemistry I	4
CH 223	Organic Chemistry II	4
ARE 306	Agricultural Law or BUS 307 Business Law I or BUS 330 Human Resource Mgt. or ACC 280 Managerial Accounting	3
GN 411	Principles of Genetics	4
Group A Electives (Biol. Sci.)		4
Group A Electives		0-4
Group B or C Electives		3

*Departmental Requirements and Electives
(26 Credits)*

PO 201	Poultry Science & Prod.	4
PO (ANS,FS) 322	Muscle Foods and Eggs	3
PO 405	Avian Physiology	4
PO (ANS,NTR) 415	Comparative Nutrition	3
PO 490	Poultry Seminar	1
PO (ZO) 524	Comp. Endocrinology	4
VMF 401	Poultry Sciences	4
Minimum Hours Required for Graduation		130

TECHNOLOGY PROGRAM

The technology curriculum in poultry science is designed to prepare students for direct entry into the poultry industry upon graduation; allows a greater selection of courses in applied science and technology areas; and offers a student both basic and applied knowledge in poultry production which can be used directly in family poultry operation upon graduation.

ALS 103	Introductory Topics in ALS	1
<i>Language (12 Credits)</i>		
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
COM 110	Public Speaking	3
Literature Elective		3

*Humanities & Social Sciences
(21 Credits)*

Electives		21
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*Physical and Biological Sciences
(31-35 Credits)*

BS 100	General Biology	4
CH 101	General Chemistry	3
CH 121	General Chemistry Lab	1
CH 107	Principles of Chemistry	3
CH 127	Principles of Chemistry Lab	1
MA 111	Precalc. Algebra & Trig.	3
MA 114	Intro. to Finite Math or MA 121 Elements of Calculus or MA 131 Any. Geometry & Calc. A	3-4
MB 401	General Microbiology	4
PY 221	College Physics or PY 211 & 211 College Physics I,II	5-8
Elective in Group A (Biol. Sci.)		4

*Physical Education & Free Electives
(17 Credits)*

PE 100	Health and Physical Fitness	1
Physical Education Electives		3
Free Electives		13

PREMEDICAL SCIENCES

Premedical, pre dental, preoptometry, prepharmacy, preveterinary, and other allied health preprofessional programs are offered as foundation courses in several curricular tracks with emphasis on the physical and biological sciences. Requirements for most premedical sciences are similar. A number of students are accepted each year in leading medical colleges; several have received outstanding scholarships.

For the premedical, pre dental, and preoptometry programs, see zoology, biochemistry and the biological sciences curricula and consult Dr. William C. Grant, 111 Patterson Hall, Chair of the University Preprofessional Health Science Committee.

*Group A, B, C Courses
(15-20 Credits)*

CH 220	Intro. Organic Chemistry or CH 221 Organic Chemistry I	4
ARE 306	Agricultural Law or BUS 307 Business Law I or BUS 330 Human Resource Management or ACC 280 Managerial Accounting	3
GN 301	Genetics in Human Affairs or GN 411 Principles of Genetics	3-4
Electives in A, B, or C Courses		5-10

*Departmental Requirements & Electives
(28 Credits)*

PO 201	Poultry Science & Production	4
PO 301	Evaluation of Live Poultry	2
PO (ANS,FS) 322	Muscle Foods & Eggs	3
PO 405	Avian Physiology	4
PO (ANS, NTR) 415	Comparative Nutr.	3
PO 490	Poultry Seminar	1
PO (GN) 520	Poultry Breeding	3
VMF 401	Poultry Diseases	4
Select a minimum of two courses from:		4
PO 420	Turkey Production (2)	
PO 421	Comm. Egg Production (2)	
PO 422	Incub. & Hatchery Mgt. (2)	
PO 423	Broiler Production (2)	
Minimum Hours Required for Graduation		130

PRE-PROFESSIONAL PROGRAM IN VETERINARY MEDICINE

Students with interests in veterinary medicine who enroll in the undergraduate programs at North Carolina State University should pursue a baccalaureate degree in a major area that fulfills the requirements of the pre professional program. Pre-professional courses are designed to give students a background in animal health, poultry health and laboratory animal care. At the present time a preveterinary curriculum is offered in the College of Agriculture and Life Sciences. A student may major in animal science, poultry science, biochemistry, zoology, biological sciences, or biological sciences options, as well as in other science curricula. The choice of the degree program should be carefully considered to encompass alternate career objectives. If a student is accepted to veterinary college before completion of his or her undergraduate degree, some course credits may be transferred from the veterinary program toward completion of the Bachelor of Science degree. Arrangements for this procedure should be made with the degree-granting college or department prior to entering veterinary college.

The courses listed below are minimum requirements for all students applying for entrance to the College of Veterinary Medicine at N. C. State University. A grade of C or better on each course and an overall grade point average of 2.75 or above is required for application.

Language

	<i>Credits</i>
ENG 111, 112 English Composition	6

Physical Sciences

BCH 451 Introduction to Biochemistry	3
CH 101, 121 General Chemistry & Laboratory	4
CH 107, 127 Principles of Chemistry & Laboratory	1
CH 221, 223 Organic Chemistry I & II	8
MA 121 Elements of Calculus or MA 131 Analytical Geometry & Calc. A	1
PY 211, 212 College Physics or PY 221 College Physics	8.5
ST 311 Introduction to Statistics	3

Biological Sciences

BS 100 General Biology	1
GN 411 Principles of Genetics	1
MB 401 General Microbiology	4

Nutrition

At least one course in animal nutrition is necessary	
ANS 250 Applied Animal Nutrition or ANS (FS, NTR) 301 Introduction to Human Nutrition or ANS (INTR, PO) 415 Comparative Nutrition	3

Faculty Advisers have a list of suggested courses for pre-professional students.

SOCIOLOGY AND ANTHROPOLOGY

(Also See Humanities and Social Sciences)

1911 Building (Room 301)

Professor W. C. Clifford, Interim Head of the Department

Associate Professor M. T. Zingraff, Interim Associate Head

Associate Professor A. C. Davis, Undergraduate Coordinator (Applied Sociology)

Professor M. D. Schulman, Director of Graduate Programs

Associate Professor R. J. Thomson, Undergraduate Administrator

Associate Professor S. K. Garber, Extension Specialist In Charge

TEACHING, RESEARCH AND EXTENSION FACULTY

Professors: L. R. Della Fave, V. E. Hamilton, V. A. Hiday, R. L. Moxley, L. B. Otto, M. M. Sawhney, R. C. Wimberley;
Professors Emeriti: J. N. Collins, E. M. Crawford, T. N. Hobgood, Jr., C. P. Marsh, P. P. Thompson, Odell Uzzeil,
M. E. Voland, J. N. Young; *Associate Professors:* M. P. Atkinson, R. C. Brisson, R. F. Czaja, G. D. Hill, T. J. Hoban,
J. C. Leiter, S. C. Lilley, G. S. Nickerson, I. Rovner, M. S. Thompson, D. T. Tomaskovic-Devey, K. M. Troost, M. L.
Walek, J. M. Wallace, E. M. Woodrum; *Associate Professor Emeritus:* J. G. Peck; *Assistant Professors:* R. S. Ellovich,
P. L. McCall, M. L. Schwalbe, C. R. Zimmer; *Assistant Professors Emeriti:* C. G. Dawson, T. M. Hyman; *Associate
Member of the Faculty:* R. D. Mustian (Adult and Community College Education).

This department teaches students the principles and techniques for understanding human group behavior. More specifically the department seeks: (1) to educate students to understand communities and organizations and the people who live and work within them; (2) to qualify exceptional students at the undergraduate and graduate level for sociological research, teaching, and extension careers; (3) to solve problems in human group relations. Applied sociology is good training for a wide variety of careers. It is useful for any job which involves work with people, organizations or communities. It is also good preparation for professional careers in local government, personnel relations, law, the clergy, business and management.

CURRICULUM IN APPLIED SOCIOLOGY

The degree of Bachelor of Science with a major in applied sociology is offered under the science curriculum of the College of Agriculture and Life Sciences. In addition to topics in agricultural and community sociology, majors in this department have the option of concentrating in criminal justice.

SCIENCE PROGRAM

	<i>Credits</i>		<i>Physical and Biological Sciences (29 Credits)</i>
ALS 103 Introductory Topics in ALS	1		
<i>Languages (12 Credits)</i>			
ENG 111 Composition and Rhetoric	3	BS 100 General Biology or	
ENG 112 Composition and Reading	3	BS 105 Biology in the Modern World	4
Language or Communication Elective	3	CH 101 General Chemistry I and	
Literature Elective	3	CH 121 General Chemistry Laboratory or	
		CH 100 Chemistry and Society	4
<i>Humanities and Social Sciences (21 Credits)</i>		CSC 200 Intro. to Computers and Their Use or	
ANT 252 Cultural Anthropology	3	Computer Science Elective	3
EC 201 Introduction to Economics or		MA 111 Precalculus Algebra and	
ARE 212 Economics of Agriculture	3	Trigonometry	3
PS 201 Introduction to American Government or		MA 131 Analytic Geometry & Calc. A or	
PS 202 State and Local Government	3	MA 141 Analytic Geometry and Calculus I	4
SOC 202 Principles of Sociology	3	PY 221 College Physics	5
Electives (Six hours must come from		ST 311 Introduction to Statistics	3
Humanities—Group D, Area I Discipline)	9	Physical or Biological Science	3

<i>Physical Education and Free Electives</i>	
<i>(17 Credits)</i>	
PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Free Electives	13

<i>Group A, B, C, D Courses</i>	
<i>(22 Credits)</i>	
ANT 251 Physical Anthropology	3
GN 301 Genetics in Human Affairs or	
GN 411 The Principles of Genetics	3-4
SOC 351 Population and Planning	3
Electives in A, B, C, or D Courses	12 13

<i>Departmental Requirements and Electives</i>	
<i>(28 Credits)</i>	
SOC 241 Rural Society, USA	3
SOC 300 Sociological Research Methods	4
SOC 301 Human Behavior	3
SOC 311 Community Relationships	3
SOC Elective at 300 or 400 Level	3
SOC 400 Theories of Social Structure or	
SOC 401 Theories of Social Interaction	3
SOC 410 Formal Organizations	3
SOC 485 Field Work in Applied Soc.	3
SOC Elective at 400 level or above	3
Strongly Recommended: For students interested in applied quantitative methods, PS 471, SOC 590 and additional courses in statistics.	

Minimum Hours Required for Graduation ... 130

CONCENTRATION IN CRIMINAL JUSTICE
(ALS 103, Languages, Physical and Social Sciences, Physical Education and Free Electives are same as above.)

MINOR IN APPLIED SOCIOLOGY

The Minor in Applied Sociology is a 15-hour program aimed at providing students the basic conceptual framework of sociology and the information necessary for applying this approach to the resolution of problems, especially in the work and organizational environments.

SOIL SCIENCE

Williams Hall (Room 2234)

Professor E. J. Kamprath, Head of the Department and Graduate Coordinator

Professor J. P. Zublena, Extension Specialist In Charge

Associate Professor H. J. Kleiss, Undergraduate Coordinator

TEACHING, RESEARCH, AND EXTENSION FACULTY

Alumni Distinguished Graduate Professor: S. W. Buol

William Neal Reynolds Professors: S. W. Buol, E. J. Kamprath

Professors: D. K. Cassel, F. R. Cox, J. W. Gilliam, T. L. Grove, D. W. Israel (USDA), L. D. King, G. S. Miner, C. D. Raper, Jr., R. J. Volk, A. G. Wollum; Adjunct Professors: P. G. Hunt, R. J. McCracken; Professors Emeriti: J. V. Baird, W. V. Bartholomew, M. G. Cook, G. A. Cummings, R. W. Cummings, J. W. Fitta, W. A. Jackson, C. B. McCants, J. A. Phillips, P. A. Sanchez, S. B. Weed; Associate Professors: A. Amoosegar, S. W. Broome, G. D. Hoyt, M. T. Hoover, J. P. Lilly, G. C. Naderman, J. E. Shelton, T. J. Smyth, M. J. Vepraskas, M. G. Waggoner; Adjunct Associate Professor: M. R. Tucker; Associate Professor Emerita: R. E. McCollum; Assistant Professor: R. L. Mikkelsen; Assistant Professor Emerita: C. K. Martin; Senior Researcher: W. P. Robarge; Associate Members of the Faculty: E. D. Seneca (Botany); H. L. Allen, L. T. Henry, R. Lea (Forestry); S. R. Shafer (Plant Pathology); R. W. Skaggs (Biological and Agricultural Engineering); G. F. Peedin, J. B. Weber (Crop Science).

Humanities and Social Sciences

(81 Credits)

ANT 252 Cultural Anthropology	3
EC 201 Introduction to Economics or	
ARE 212 Economics of Agriculture	3
PS 201 Introduction to American Government	3
PS 311 Criminal Justice Policy Process	3
SOC 202 Principles of Sociology	3
Electives for Humanities—Group D	
Area I discipline	6

Group A, B, C, D Courses

(22 Credits)

ANT 251 Physical Anthropology	3
GN 301 Genetics in Human Affairs or	
GN 411 The Principles of Genetics	3-4
SOC 306 Criminology	3
SOC 351 Population and Planning	3
SOC (PS 413 Criminal Justice Field Work	4
Political Science Elective	3
Electives	2-3

Departmental Requirements

(28 Credits)

SOC 241 Rural Society USA	3
SOC 300 Sociological Research Methods	4
SOC 301 Human Behavior	3
SOC Elective at 300 or 400 Level	3
SOC 400 Theories of Social Structure or	
SOC 401 Theories of Social Interaction	3
Criminal Justice Electives	12
(must include 3 courses in Sociology and one course in Political Science... See adviser for listing.)	

The Department of Soil Science trains students in fundamentals of soils, develops an understanding and appreciation of soils as a resource, and presents principles of soil management and utilization for both farm and non agricultural purposes. Soils constitute one of the largest capital investments in farming, and proper soil management is essential for efficient production. Future world food needs will require people conversant in soil resources and use of fertilizers. Soil properties are important considerations in urban-suburban planning and development. Also, knowledge of soil and its interactions with potential pollutants is essential in maintaining environmental quality. Therefore, the demand for people trained in soils by private consultants, agribusiness, research, service, planning development, education and conservation related agencies should continue to be great.

OPPORTUNITIES

Soil Science graduates fill positions of leadership and service in land resource planning, conservation, natural resource management and agriculture. Among these are opportunities as farm operators and managers, county agricultural extension agents and employees of other public advisory agencies, Soil Conservation Service and other conservation related agencies concerned with soil resources. Graduates also serve as technical representatives and salesmen in fertilizer companies and in other agribusiness activities. Many opportunities exist for private consulting soil scientists who serve a variety of clientele needs. Environmental concerns usually require soil science expertise, especially in land-based waste management.

Provision is made for students wishing a more thorough training in biological sciences, chemistry, mathematics and physics leading to graduate study. (See listing of graduate degrees.) Students with advanced degrees have wide opportunities in teaching, research, service and extension with state, federal and private educational and research institutions and agencies.

UNDERGRADUATE CURRICULA

The Bachelor of Science degree may be obtained with majors in agronomy or natural resources. The agronomy program is administered jointly with the Crop Science Department. A soil science concentration is available in the agronomy curriculum. Two soils concentrations are available in the natural resources curriculum, soil resources and soil and water resource systems. (The agronomy and natural resources curricula are shown earlier under College of Agriculture and Life Sciences.)

MINOR IN SOIL SCIENCE

The academic minor in Soil Science is offered to students desiring a strong knowledge of the principles of Soil Science to complement their major. It is intended to strengthen the understanding of basic physical and chemical soil properties that would be relevant to a student's particular land management interest. These interests may include but are not limited to conservation, forestry, geology, landscape architecture, horticulture, biological and agricultural engineering, agricultural business management, or agricultural education. Fifteen hours of required courses and three hours of electives are necessary to complete the minor.

TOXICOLOGY

Method Unit IV

Professor E. Hodgson, Head of the Department

Associate Professor R. C. Smart, Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

William Neal Reynolds Professor: E. Hodgson

Professor: W. C. Dauterman; Adjunct Professors: J. A. Bond, G. R. Burselon, J. R. Fouts, J. A. Goldstein, R. J. Langenbach, R. O. McClellan, R. M. Philpot, R. J. Preston; Professors Emeriti: F. E. Guthrie, T. J. Sheets; Associate Professor: R. B. Leidy; Adjunct Associate Professors: N. A. Chernoff, H. B. Matthews; Assistant Professor: G. A. LeBlanc, D. Shea, M. B. St.Clair; Adjunct Assistant Professor: F. G. Burselon; Research Associate Professor: P. E. Levi; Research Assistant Professor: S. A. Meyer; Associate Members of the Faculty: H. M. Hassan (Biochemistry, Food Science, Microbiology); M. W. Anderson (Biomathematics); W. W. Heck (Botany); R. J. Linderman (Chemistry); D. E. Moreland (Crop Science, Botany, Forestry); R. J. Kuhr, R. M. Roe (Entomology); W. H. McKenzie (Genetics); W. E. Donaldson (Poultry Science); P. B. Hamilton (Poultry Science, Microbiology); M. A. Qureshi (Poultry Science, Microbiology, Veterinary Medicine); C. Brownie (Statistics); K. B. Adler, A. L. Aronson, C. F. Brownie, T. E. Eling, N. Monteiro-Riviere, J. E. Riviere, C. L. Robinette, B. A. Schwetz (Veterinary Medicine); W. J. Fleming (Zoology, Forestry).

The Department of Toxicology offers courses of study leading to the Master of Toxicology, Master of Science and Doctor of Philosophy degrees. The Department of Toxicology trains qualified individuals to conduct basic and applied scientific research on the mechanisms of chemically induced toxicity, to advance toxicology as a science and to communicate concepts of toxicology.

ZOOLOGY

Gardner Hall (Room 1627—South Wing)

Professor H. F. Heatwole, Head of the Department

Professor G. C. Miller, Undergraduate Coordinator

Professor D. E. Smith, Graduate Coordinator

TEACHING, RESEARCH AND EXTENSION FACULTY

Alumni Distinguished Undergraduate Professor: J. F. Roberts

Professors: G. T. Barthalmus, P. C. Bradbury, B. J. Copeland, L. B. Crowder, P. D. Doerr, W. C. Grant, C. F. Lytle, J. M. Miller, R. L. Noble, H. A. Underwood, J. G. Vandenberg, J. R. Walters; Professors Emeriti: D. E. Davis, W. W. Haasler, M. T. Huish, T. L. Quay; Associate Professor: B. L. Black, P. T. Bromley, M. N. Feaver, W. J. Fleming (USDI), J. P. Gilliam, R. M. Grossfeld, J. M. Hinshaw, R. G. Hodson, S. C. Mozley, R. A. Powell, J. A. Rice; Adjunct Associate Professors: W. T. Hogarth, C. S. Manooch, III, D. S. Peters, L. W. Reiter, G. J. San Julian; Assistant Professors: J. A. Collazo (USDI), J. E. Hightower (USDI), T. M. Losordo, C. V. Sullivan; Adjunct Assistant Professors: E. M. Bennett, S. V. Chiavetta, D. R. Colby, R. J. Kavlock; Adjunct Instructor: R. B. Hamilton; Associate Members of the Faculty: B. H. Grimes (Interdisciplinary Studies), E. J. Jones (Extension Forest Resources), R. A. Lancia (Forest Resources), K. H. Pollock (Statistics), T. G. Wolcott (Engineering and Marine, Earth and Atmospheric Sciences).

Affiliated Faculty, Medical Technology Programs

Bowman Gray School of Medicine/N.C. Baptist Hospital
Michael O'Connor, M. D. Medical Director
Lenora Flynn, MT(ASCP), A.B., M.Ed.

Carolinas Medical Center—
Edward H. Lipford, III, M.D., Medical Director
Elizabeth T. Anderson, M.H.D., MT(ASCP), CLS(NCA), Program Director

Duke University Medical Center—
Frances K. Widmann, M.D., Medical Director
Linda L. Seefried, MA, CLSup(NCA), MT(ASCP), Program Director

Moses Cone Memorial Hospital
 Mary Steuterman, M.D., Medical Director
 Theresa O'Laughlin, M.C.I.T. M.T.A.S.C.P.I., S.H., Program Director

Forsyth Hospital
 Joseph B. Duffles, M.D., Medical Director
 Donna G. Basch, M.T.A.S.C.P.I.S.C., Program Director

Presbyterian Hospital
 Foster J. Sanders, Jr., M.D., Medical Director
 Rebecca Summers, M.T.A.S.C.P.I., Program Director

The Department of Zoology provides undergraduate and graduate instruction in specialized biological sciences areas. Undergraduates study all levels of biological organization from the molecular to the community. Zoology majors are well prepared for graduate work in zoology and related fields of sciences. (See listing of graduate degrees.) Participation in supervised programs of research is strongly encouraged. A strong science background is provided for students planning to enter dentistry, medicine, optometry, veterinary medicine and allied health sciences, such as medical technology. Ecology, including wildlife, fisheries, parasitology and marine biology are strong areas. Cellular and molecular biology, including neurobiology, also are emphasized.

OPPORTUNITIES

Bachelor of Science graduates in zoology have many career options. Graduates are well prepared for employment in various government agencies or private industries. Graduates may continue their education with studies leading to advanced degrees in many areas of biological sciences such as zoology, cell biology, wildlife and fisheries science, marine science and biomedical subdisciplines. Many also choose to enter professional schools for degrees in medicine, dentistry, veterinary medicine and other health related areas.

UNDERGRADUATE CURRICULA

The Bachelor of Science degree with a major in zoology, fisheries and wildlife sciences or medical technology is offered under the science curriculum of the College of Agriculture and Life Sciences. Within these majors a student may specialize depending upon interest and ability.

The zoology curriculum prepares students for graduate school, medical, dental, and veterinary schools. Certain professional schools have specific requirements which differ slightly from the zoology curriculum. Students should consult catalogs of specific professional schools to ensure completion of any special requirements.

Other curricula include the fisheries and wildlife sciences program and the medical technology program. The clinical year for the medical technology program is by competitive selection at an affiliated hospital. Students are advised by faculty in their special areas of interest.

CURRICULUM IN ZOOLOGY

<i>Credits</i>	<i>Physical and Biological Sciences</i> (42 Credits)
ALS 103 Introductory Topics in ALS	BS 100 General Biology
1	CH 101 General Chemistry
<i>Language (12 Credits)</i>	CH 121 General Chemistry Lab
ENG 111 Composition and Rhetoric	CH 107 Principles of Chemistry
3	CH 127 Principles of Chemistry Lab
ENG 112 Composition and Reading	CH 221 Organic Chemistry I
3	CH 223 Organic Chemistry II
Literature Elective	GN 411 Principles of Genetics
3	MA 111 Precalculus Algebra and Trig.
Language or Communication Elective	MA 121 Elements of Calculus or
3	MA 131 Analytic Geometry & Calculus A.
<i>Humanities and Social Sciences</i> (21 Credits)	PY 211 College Physics I
Electives (no more than three	PY 212 College Physics II
in any one department)	Mathematics Science Elective: second calculus or
21	computer science or ST 311
	3

<i>Physical Education and Free Electives</i> (16 Credits)	<i>Departmental Requirements and Electives</i> (28 Credits)
PE 100 Health and Physical Fitness 1	ZO 205 Intro. to Cellular & Dev. Zool. 4
Physical Education Electives 3	ZO 206 Intro. to Organismal & Evol. Zool. 4
Free Electives 12	ZO 305 Cell & Animal Physiology Lab 2
<i>Group A Electives</i> (10 Credits)	Selected Zoology Electives ¹ 15
Restricted Electives 10	Selected Laboratory Courses ² 3
	Hours Required for Graduation 130

¹Zoology Electives: 15 credit hours to be selected from the following with at least one course from each category.

<i>Organismal Level</i>	<i>System Level</i>
ZO 303 (3)	ZO 421 (3)
ZO 315 (3)	ZO 361 (3)
ZO 402 (2)	ZO 370 (3)
ZO 441 (3)	ZO 371 (3)
<i>Cellular and Molecular Level</i>	<i>Supraorganismal Level</i>
BCH 451 (3)	BO ZO 360 (3)
BO ZO 414 (3)	ZO 410 (3)
ZO 370 (3)	ZO 450 (3)
ZO 371 (3)	

²Zoology Laboratories: 3 credit hours of laboratory work are to be selected from the following:

BCH 452 (2)	ZO 376 (2)
GN 412 (1)	ZO 403 (2)
ZO 304 (1)	ZO 442 (1)
ZO 365 (1) ZO 360 (3) is a corequisite	ZO 460 (2)
ZO 375 (2)	ZO 480 (3)

SPECIFIC RECOMMENDATIONS FOR RESTRICTED ELECTIVES

(SDM) Medical Schools and Dental Schools:
ZO 315; BCH 451 GN 412; MB 401, 411

(SZO) Zoology:
BO 200; BCH 451- ENT 425; FW 221, 420- MB 401, 411 GN 412; ZO 212, 315, 411, 420, 425, 441 and any 500 level course and any approved computer science statistics or mathematics course.

(See also Pre Professional Program in Veterinary Medicine).

MINOR IN ZOOLOGY

A minor in Zoology is available to undergraduates majoring in any department other than Zoology. This minor will be useful to students applying to professional schools such as medicine, dentistry, veterinary medicine, and other health sciences. Basic knowledge in animal biology may also be useful to students seeking careers in government, industry, or education. The minor consists of a minimum of 15 credit hours, including two core courses, ZO 205 and ZO 208. The remaining courses must be selected from three or four-credit courses at the 300 or 400 level with at least one course having a laboratory.

SCIENCE PROGRAM IN MEDICAL TECHNOLOGY

Professor G. C. Miller, Undergraduate Coordinator

Two programs are available in medical technology. The first is a four year collegiate curriculum with a Bachelor of Science degree in Zoology (see above) followed by a year of training in any hospital clinical laboratory approved by the American Medical Association. The second program is designed to be completed in four calendar years. The student takes the prescribed curriculum (see below) for three years at NCSU and a fourth year (12 months) of clinical training at an affiliated hospital. Successful completion of this program qualifies the student for a Bachelor of Science degree in Medical Technology from NCSU. Acceptance by the clinical laboratory is competitive and students in either program outlined above must apply for clinical training. After completion of either program the student is eligible to take the national examination for certification as a registered Medical Technologist.

CURRICULUM IN MEDICAL TECHNOLOGY

	<i>Credits</i>
ALS 103 Introductory Topics in ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
English, Language, or Communication Elective	3
Literature Elective	3
<i>Humanities and Social Sciences (21 Credits)</i>	
Electives (no more than three in any one department)	21
<i>Physical and Biological Sciences (27 Credits)</i>	
BS 100 General Biology	4
CH 101 General Chemistry I	3
CH 121 General Chemistry I Lab	1
CH 107 Principles of Chemistry	3
CH 127 Principles of Chemistry Lab	1
MA 111 Precalculus Algebra and Trig.	3
MA 121 Elements of Calculus or	
MA 131 Analytic Geometry & Calculus A	4
PY 211 College Physics I	4
PY 212 College Physics II	4

plus

Twelve month course in Medical Technology at one of the affiliated hospital programs.

Microbiology	<i>35-50 hours (variable in the four programs)</i>
Clinical Chemistry	
Hematology	
Histology & Cytology	
Minimum Hours Required for Graduation	135

The affiliated programs are:

Bowman Gray School of Medicine, Winston-Salem, NC
 Carolinas Medical Center, Charlotte, NC
 Moses H. Cone Hospital, Greensboro, NC
 Duke University Medical Center, Durham, NC
 Presbyterian Hospital, Charlotte, NC
 Forsyth Memorial Hospital, Winston-Salem, NC

<i>Physical Education and Free Electives (8-9 Credits)</i>	
PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Free Electives	4-5
<i>Group A Courses (19-20 Credits)</i>	
CH 221 Organic Chemistry I	4
CH 223 Organic Chemistry II	4
GN 301 Genetics in Human Affairs or	
GN 411 The Principles of Genetics	3-4
MB 401 General Microbiology	4
MB 411 Medical Microbiology	4
<i>Departmental Requirements and Electives (11 Credits)</i>	
ZO 201 General Zoology	4
ZO 303 Vertebrate Zoology	3
ZO 304 Vertebrate Zoology Laboratory	1
ZO (BO) 414 Cell Biology or	
ZO 421 Principles of Physiology	3
	100

FISHERIES AND WILDLIFE SCIENCES

Professor R. L. Noble, Undergraduate Coordinator

The Departments of Zoology and Forestry jointly administer the program in Fisheries and Wildlife Sciences. Undergraduate education emphasizes ecological principles and their application to research problems and natural resource management needs. Majors are well prepared for graduate work and entry-level professional positions.

CURRICULUM IN FISHERIES AND WILDLIFE SCIENCES

	<i>Credits</i>		<i>Humanities and Social Sciences (21 Credits)</i>
ALS 103 Introductory Topics in ALS	1	Economics Electives	6
<i>Languages (12 Credits)</i>		Literature Elective	3
ENG 111 Composition and Rhetoric	3	Political Science Electives	6
ENG 112 Composition and Reading	3	Electives (3 credits must come from Humanities— Group D, Area I Discipline)	6
ENG 333 Commun. for Science & Res.	3		
COM 110 Public Speaking	3		

<i>Physical and Biological Sciences</i> (49-50 Credits)			
BO (ZO) 360	Introduction to Ecology	3	
BO (ZO) 365	Ecology Lab	1	
BS 100	General Biology	4	
CH 101/121	General Chemistry & Lab	4	
CH 107/127	Principles of Chemistry & Lab	4	
CH 221, 223	Organic Chemistry I and II or		
CH 220	Intro. Org. Chem. and a Phys. Sci. Elective	8	
GN 301	Genetics in Human Affairs or		
GN 411	Principles of Genetics	3-4	
MA 131	Analytic Geometry and Calculus A	4	
PY 221	College Physics	5	
ST 311	Intro. to Statistics and one of the following		
	BAE 241, CSC 200, FOR 273,		
	MA 214, MA 231	6	
ZO 201	General Zoology	4	
ZO 421	Principles of Physiology	3	

Physical Education and Free Electives
(12-15 Credits)

PE 100	Health and Physical Fitness	1
	Physical Education Electives	3
	Electives	8-11

Group A, B, C Courses
(Wildlife - 9 Credits) (Fisheries - 12 Credits)

	<i>Credits</i>	<i>Fisheries</i>	<i>Wildlife</i>
ANS (PO,NTR) 415	Comparative Nutrition	3	X
ANS 502	Reprod. Physiol. of Vertebrates	3	X
BO 565	Plant Community Ecology	4	X
BO 574	Physiology	3	X
CE 486	Sanitary Engineering Measurements of Water Quality	3	X
ENT (ZO) 425	General Entomology	3	X
FOR 212	Dendrology	4	X
FOR 252	Intro. to Forest Science	3	X
FOR 353	Air Photo Interpretation and Photogrammetry	3	X
FOR 401	Forest Hydrology and Watershed Management	4	X
FOR (FW) 404	Forest Wildlife Management	3	X
FOR 472	Renewable Resource Policy and Management	3	X
FW (ZO) 515	Fish Physiology	3	X
FW (ZO) 554	Wildlife Field Studies	3	X
FW (ZO) 586	Aquaculture I	3	X
FW (ZO) 587	Aquaculture I Laboratory	1	X
MB 501	Advanced Microbiology I	3	X
MEA 200	Intro. to the Marine Environment	3	X
MEA (ZO) 520	Princ. of Biol. Oceanography	3	X
PRT 442	Recreation and Park Interpretation	3	X
SSC 200	Soil Science	4	X
SSC 452	Soil Classification	4	X
ZO 315	General Parasitology	3	X
ZO 419	Introduction to Limnology	4	X
ZO 501	Ornithology	3	X
ZO 517	Population Ecology	3	X
ZO 544	Mammalogy	3	X

Departmental Requirements and Electives
(Wildlife - 32 Credits) (Fisheries - 29 Credits)

	<i>Credits</i>	<i>Fisheries</i>	<i>Wildlife</i>
BO 200	Plant Life	4	X
BO 403	Systematic Botany	4	X
FW (ZO) 221	Conserv. of Natural Resources	3	X
FW (FOR) 310	Fisheries and Wildlife Inventory and Management	6	X
FW (ZO) 353	Wildlife Management	3	X
FW (FOR) 404	Forest Wildlife Management	3	X
FW (ZO) 420	Fishery Science	3	X
FW (ZO) 430	Fish and Wildlife Administration, Policy and Law	3	X
FW (ZO) 553	Principles of Wildlife Science	3	X
ZO 441	Biology of Fishes	3	X
ZO 442	Biology of Fishes Laboratory	1	X
ZO 419	Introduction to Limnology	4	X
Minimum Hours Required for Graduation	136		

N. C. AGRICULTURAL RESEARCH SERVICE

D. F. Bateman, *Dean of Agriculture and Life Sciences*

J. C. Wynne, *Associate Dean and Director of N. C. Agricultural Research Service, College of Agriculture and Life Sciences*

G. J. Kriz, *Associate Director*

W. H. Johnson, *Assistant Director of Research*

S. A. Lommel, *Assistant Director of Research*

J. A. Britt, *Assistant Director and Associate Dean, College of Veterinary Medicine*

R. Lea, *Assistant Director and Associate Dean, College of Forest Resources*

E. Powers, *Interim Dean, School of Human Environmental Sciences, UNC G.*

The North Carolina Agricultural Research Service is the agricultural, life sciences, forestry, and home economics research agency of the State of North Carolina. It is funded principally by appropriations from the North Carolina General Assembly, federal formula funds and grants and contracts.

The purpose of the N. C. Agricultural Research Service is to conduct research on (1) the development and maintenance of an effective agricultural and forestry industry in North Carolina, including economically sound sources of supplies and equipment needed in agriculture and forestry and market outlets for the products of agriculture and forestry, (2) the improvement of rural homes, rural life and rural environment, and (3) the maintenance of a reliable supply of agricultural and forestry products for the consuming public. This requires research to solve current problems and research to provide a foundation of scientific knowledge in the biological, physical and social sciences.

The N. C. Agricultural Research Service faculty brings well-trained personnel to the University, whose teaching in many specialized fields of agriculture, biology and the social sciences assures the maintenance of curricula of high standards. It contributes to the advanced training of students who are destined to become the leaders, teachers and investigators necessary in the maintenance of agriculture and forestry on a sound economic plane.

PUBLICATIONS

The N. C. Agricultural Research Service publishes bulletins and scientific papers on research conducted by the staff. Copies of bulletins may be obtained from the Department of Agricultural Communications and scientific papers from the author.

SERVICES

The faculty of the N. C. Agricultural Research Service conduct original and other research bearing directly on and contributing to the establishment and maintenance of permanent and effective agricultural and forestry industries in North Carolina. This research includes field and laboratory experimentation in the biological, physical, social, and environmental sciences. Primary emphasis is given to the production, processing, distribution, and consumption of the many agricultural and forestry commodities produced throughout the state. Also, major attention is given to research programs aimed at improving the quality of life of both rural and urban peoples.

COOPERATIVE EXTENSION SERVICE

D. F. Bateman, *Dean of Agriculture and Life Sciences*

R. C. Wells, *Associate Dean and Director of the Cooperative Extension Service*

R. E. Phillips, *Associate Director of Extension*

The Cooperative Extension Service of North Carolina State University is a cooperative undertaking among the United States Department of Agriculture, the State of North Carolina, the 100 counties in the state and the Cherokee Indian Reservation. Its work is supported by federal funds made available under the Smith Lever Act of 1914, as amended by state and county appropriations, and by grants and contracts.

The federal and state appropriations are used to maintain an administrative and specialist staff and to pay a portion of the salary and the travel expenses of the county extension agents. Under this cooperative arrangement, the Cooperative Extension Service serves as the "educational arm" of the United States Department of Agriculture and as the "field faculty" of North Carolina State University in the areas of agriculture and natural resources; family living; 4-H and youth; and community and rural development.

The primary purpose of the North Carolina Cooperative Extension Service is to provide the people of the state with the latest and best information particularly that which is related to agriculture and natural resources; home economics and youth; and rural development and help them to interpret and use this information in building a more prosperous and satisfying life.

This program has sufficient flexibility to permit special attention to the problems, needs and interests of the people in each county. County Advisory Councils are utilized to determine and prioritize the county educational program content. Assistance is given to individuals, families, communities, agricultural and seafood processing and marketing firms, other businesses and certain organizations. This includes work with adults and youth in both the city and rural areas.

In carrying out this educational program, a variety of methods and techniques are employed: method and result demonstrations; meetings; visits to farms, homes and businesses; organized groups of men, women and youth; tours; leaflets, pamphlets and other printed materials and mass media.

The basic sources of information to be taught through this educational program are the findings and recommendations resulting from research conducted by the Agricultural Research Service in this and other states and by the United States Department of Agriculture.

AGRICULTURAL INSTITUTE

Patterson Hall (Room 107)

D. F. Bateman, *Dean of Agriculture and Life Sciences*

J. L. Oblinger, *Associate Dean and Director of Academic Programs*

K. L. Esbenshade, *Assistant Director of Academic Programs and Director of the Agricultural Institute*

The Agricultural Institute is a two-year academic program which awards the Associate in Applied Science Degree upon successful completion of at least one of eight curricula. The Agricultural Institute provides education and training in food, agriculture, horticulture, turfgrass management and agribusiness. It is part of the academic programs in the College of Agriculture and Life Sciences at North Carolina State University. Provision for the Agricultural Institute was made by the 1959 North Carolina General Assembly and instruction began in the Fall, 1960. The objective of the Agricultural Institute is to provide technical training for those desiring a comprehensive education in the food and agricultural sciences, agribusiness and related areas.

The instructional programs of the Agricultural Institute are organized and conducted as part of the overall academic program in the College of Agriculture and Life Sciences. The Agricultural Institute is an addition to, and not a substitute for, the college's regular degree granting program. The Agricultural Institute uses the same facilities (classrooms, laboratories, farms) as the four-year program. The facilities are used extensively for both teaching and observing the application of technology in agriculture and other closely related areas.

The faculty for the four-year program are responsible for organizing and teaching courses offered by the Agricultural Institute. Emphasis is placed on practical knowledge and training, with many courses requiring laboratories for hands-on experiences. The Agricultural Institute offers majors in eight areas: Agribusiness Management; Agricultural Pest Control; Field Crops Technology; Food Processing, Distribution and Service; General Agriculture; Livestock Management and Technology; Ornamentals and Landscape Technology; and Turfgrass Management.

OPPORTUNITIES

Rapid technical advancement has been important in changing agriculture from a small production industry to the nation's largest industry. Closely associated with production agriculture are those areas related to recreation and beautification such as turfgrass management, landscaping and ornamental plants. Increased production and consumer demand for convenience type foods have stimulated the food processing industry, in turn increasing food distribution requirements.

Today's complex agriculture requires a large work force. This work force must have some technical training and be able to deal with a vast array of problems and opportunities. Graduates of the Agricultural Institute have the education and training that is in demand by the food and agricultural industries and that permit them to assume responsible positions in the agriculture and allied fields. Some career examples are: farm and herd managers, golf course superintendents, nursery managers, pest control specialists, quality control technicians, food service supervisors, sales and service of agricultural equipment and products, food inspectors, lawn care specialists and others. More job opportunities than graduates make salaries attractive.

The College of Agriculture and Life Sciences maintains a Career Development and Placement Office to assist graduates in finding employment.

ENTRANCE REQUIREMENTS

Any individual who has received a diploma from an accredited high school or has passed the high school equivalency examination administered by the Department of Community Colleges is eligible for admission consideration. Each application will be reviewed and evaluated by the Director of the Agricultural Institute.

For additional information write: Director, Agricultural Institute, Box 7642, 107 Patter son Hall, North Carolina State University, Raleigh, NC 27695 7642, or call (919) 515-3248.

PROGRAMS OF STUDY

Graduates of the Agricultural Institute are awarded the Associate in Applied Science degree. The eight programs of study are: Agribusiness Management; Agricultural Pest Control; Field Crops Technology; Ornamentals and Landscape Technology; Food Processing, Distribution, and Service; General Agriculture; Livestock Management and Technology (general livestock option, dairy option, swine option); and Turfgrass Management.

SCHOOL OF DESIGN

Brooks Hall

J. T. Regan, *Dean*

G. Bizios, *Associate Dean*

J. P. Rand, *Assistant Dean*

H. Khachatoorian, *Interim Associate Dean for Research*

V. Aldridge, *Administrative Assistant*

C. Carlton, *Librarian, Design Library*

W. K. Bayley, *Learning Resources Specialist, Media Center*

W. Godwin, *Learning Resources Specialist, Computer Center*

R. Goldberg, *Learning Resources Specialist, Materials Processing Lab*

The School of Design, since its beginning in 1948, has addressed design in the broadest sense involving the disciplines of architecture, design, graphic design, industrial design, and landscape architecture in a context of educational innovation. While the designer's traditional role is understood as that of giving meaningful form to the environment, the school gives attention to the larger responsibility of design in human, social, economic, political and behavioral terms. The school seeks to develop the designer's perception, knowledge base, skills and analytical problem solving abilities.

The expanding range of career opportunities in design is equaled by the varied interests possessed by our students. Admitted through a selective process, the school's student population is highly motivated and heterogeneous. The faculty represents an equally broad spectrum of education and professional expertise. The diversity of the faculty, both professionally and philosophically, provides unique opportunities for student development. These three factors in our educational matrix (career opportunities, student interests, and faculty expertise) are supported with a curriculum which affords each student the ability to shape, with faculty advice, a plan of study capable of facilitating his or her interests. While the school embraces the design disciplines of architecture, design, graphic design, industrial design, and landscape architecture within a departmental structure, it functions as a unified educational center, interactive and dedicated to preparing designers who are capable of shaping the environment in whatever scale they choose but in response to the needs of society.

CURRICULA AND DEGREES

The School of Design offers undergraduate instruction leading to a Bachelor of Environmental Design degree in the disciplines of architecture, design, graphic design, industrial design, and landscape architecture.

The learning activities for our students are divided into three curriculum areas: (1) general education courses including English, mathematics, humanities, social sciences, and natural sciences; (2) support courses which deal with bodies of knowledge and skills applicable to design including communication and graphics, behavior, environment, history and philosophy, physical elements and systems, methods and management (these courses are largely taught within the school but include selected University courses as well); (3) studio courses providing the arena in which students apply their skills and knowledge to problems that are both real and theoretical. These synthetic activities are time intensive and are fundamental to design education.

After the common experience in first year, the studios relate to the student's declared disciplinary major. The flexibility of the curriculum plan affords the student the opportunity to concentrate in a single discipline but facilitates his or her contact with other design principles. The curriculum reflects the reality of the environmental marketplace where, in

addition to their faculty mentors, our students are exposed to a broad range of design professionals through guest lectures, juries, projects and workshops.

Graduate studies are also offered in architecture, landscape architecture and product design. See the *Graduate Catalog* for information on the Master's Degree programs.

ARCHITECTURE

Brooks Hall

Professor C. A. Saccopoulos, Head of the Department

Associate Professor F. A. Rifki, Assistant Head

Alumni Distinguished Undergraduate Professor: P. Tesar

Professors: P. Batchlor, G. Bizas, R. Clark, J. T. Regan, J. Reuer, C. A. Saccopoulos, H. Sanoff, Professor Emeritus: V. Shigen, A. S. O. H. S. S. F. Harmon, W. Place, J. P. Rand, F. Rifki, J. Teator, P. Tesar, Associate Professor Emeritus: D. W. Barnes, Adjunct Professor: E. F. Harris, Jr. Adjunct Lecturer: T. C. Howard

In a world of changing social and cultural conditions, economics, technology, urbanization and aesthetic consciousness, the central task of the architect remains to give meaningful form to the physical environment. However, these rapid changes force today's architects to look at their world differently than did earlier generations. Modern architects must concern themselves not only with traditional design issues, but also with such emerging concerns as the preservation and adaptive use of older buildings and neighborhoods, energy conservation, and the form of rapidly expanding urban centers. The aesthetic revolution of the past few decades has freed architects from the rigidity of earlier theory, allowing greater diversity and expressiveness in architectural design.

The architecture curriculum balances professional studies with a broad general education. University requirements in mathematics, English, natural sciences and humanities are integrated with architectural design studios and a rich selection of design support courses. Central to the curriculum is the design studio—a working laboratory in which analysis and synthesis become real and meaningful activities to the architecture student.

To address the diversity of roles and responsibilities in architecture, the Department of Architecture offers several curricula. The undergraduate Bachelor of Environmental Design in Architecture is a pre-professional degree that stresses the education of the individual and serves as the foundation for advanced study in the discipline. The first year is spent on design fundamentals in a curriculum common to all students in the School of Design. In the following years students receive a broad introduction to architectural theory, history, technology and design process while exploring other educational opportunities within the University.

Following this pre-professional program students may continue their studies in either of two professional programs: the one-year, post-graduate Bachelor of Architecture or the two-year Master of Architecture program (see the *NCSU Graduate Catalog* for information on the latter program). Entry into both advanced programs is competitive; to be accepted, students must demonstrate potential for professional accomplishment, capability in design, and satisfy a specific set of professionally-oriented undergraduate course requirements. Many students spend one or more years gaining professional experience in architecture firms or related fields before pursuing the advanced degrees.

Educational enrichment is an important characteristic of the architectural program. The School of Design regularly presents public lectures by leading professionals and exhibitions of design and art work. Electives are available in related disciplines—painting, sculpture, photography, landscape architecture, industrial and graphic design. Further design exposure is available through a variety of foreign study programs and field trips to buildings and urban centers of architectural interest.

OPPORTUNITIES

Graduates with the pre-professional Bachelor of Environmental Design in Architecture degree pursue careers in architectural offices, building construction, development, and public agencies. North Carolina and many other states have restricted professional licensing in architecture to holders of accredited advanced degrees such as the Bachelor of Architecture and the Master of Architecture. This educational requirement must be followed by three years of professional internship and completion of a comprehensive examination to qualify for professional certification as an architect.

ARCHITECTURE CURRICULUM

Degree: Bachelor of Environmental Design in Architecture

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARC 141 History of Design I ¹	3	ARC 142 History of Design II ¹	3
DF 101 Des. Fundamentals Studio	6	DF 102 Des. Fundamentals Studio	6
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 131 Anly. Geo. and Calculus A ²	4	MA 231 Anly. Geo. and Calculus B ²	3
PE 100 Health and Physical Fitness	1	Physical Education Elective	1
	17		16
SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARC 211 Nat. Systems and Arch.	3	ARC 202 Arch. Design: Environment	6
ARC 263 Profession of Architecture	1	ARC 232 Structures and Materials	3
ARC 400 Architecture Studio ³	6	ARC 252 Computer Methods in Arch.	3
Env. and Behavior Elective ⁴	3	Humanities/Soc. Sci. Elect. ¹	3
Humanities/Soc. Sci. Elect. ¹	3	Physical Education Elective	1
Physical Education Elective	1		16
	17		
JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARC 331 Architectural Structures I	3	ARC 332 Architectural Structures II	3
ARC 400 Architecture Studio ³	6	ARC 302 Arch. Design: Technology	6
Natural Science Elective ⁵	4	Humanities/Soc. Sci. Elect. ¹	3
Free Elective	3	Natural Science Elective ⁵	4
	16		16
SENIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARC 400 Architecture Studio ³	6	ARC 402 Arch. Design: History	6
Design Elective ⁶	3	Design Elective ⁶	3
Design Elective ⁶	3	Free Elective	3
Humanities/Soc. Sci. Elect. ¹	3	Free Elective	3
	15		15

Minimum credit hours required for graduation: 128*

¹History of Design I and II can be counted towards satisfying humanities requirements. A list of approved courses in natural science and humanities and social sciences is available from the School of Design Registrar. Courses must be selected from that list to meet degree requirements for graduation.

²MA 121 and MA 114 may be substituted for MA 131 and MA 231. MA 111 and other lower level courses are not applicable to the 128 credit hours required for graduation.

³Two of the three ARC 400 Architecture Studios required for graduation may be substituted with design studios in other disciplines represented in the School of Design. No more than one studio may be taken in any semester.

⁴The following is a list of courses that satisfy this requirement: LAR 221 Introduction to Environment and Behavior for Designers, LAR 222 Perception and Behavior for Designers, MDS 201 Environmental Ethics, MDS 303 Humans and the Environment, SOC 203 Current Social Problems, SOC 220 Cultural Geography, SOC (ANT) 261 Technology in Society and Culture.

⁵Any School of Design course may be selected. However, if the student intends to pursue an advanced degree, such as Bachelor of Architecture or Master of Architecture, this requirement must be fulfilled with: ARC 414 Environmental Control Systems, ARC 432 Architectural Construction Systems and ARC 441 History of Contemporary Architecture.

⁶In order to receive two degrees from the School of Design, a student must complete 30 credit hours above the 128 hour requirement. These 30 hours are to include 18 credits in 400 level studios and 12 credits in design electives in the discipline, beyond those described above.

ARCHITECTURE CURRICULUM (Fifth Year)

Degree: Bachelor of Architecture

The *prerequisites* for the entry into the fifth year are:

	<i>Credits</i>
University Requirements	52
English (ENG 111 and ENG 112)	6
Mathematics (MA 131 and MA 231)	7
Natural Sciences	8
Humanities/Social Sciences (ARC 141, ARC 142 and 4 Courses)	18
Physical Education (PE 100 and 3 Courses)	4
Free Electives	9
Studios	48
Design Fundamentals (DF 101 and DF 102)	12
ARC 202	6
ARC 302	6
ARC 402	6
ARC 400 or other 400 level Design Studios ¹	18
Support Courses	28
ARC 211 Natural Systems and Architecture	3
ARC 232 Structures and Materials	3
ARC 252 Computer Methods in Architecture	3
ARC 263 Profession of Architecture	1
ARC 331 Architectural Structures I	3
ARC 332 Architectural Structures II	3
Environment and Behavior Elective	3
ARC 414 Environmental Control Systems ²	3
ARC 432 Architectural Construction Systems ²	3
ARC 441 History of Contemporary Architecture ²	3

Fifth year requirements are:

Professional curriculum courses	30
Studios (ARC 501 and ARC 502)	12
ARC 561 Practice of Architecture	3
ARC 595 Final Project Preparation	3
Architecture Elective (Four courses at 400/500 level)	12

¹Two of the three ARC 400 Architecture Studios required may be substituted with design studios in other disciplines represented in the School of Design. No more than one studio may be taken in any given semester.

²Bachelor of Architecture and Master of Architecture graduation requirement. For those who do not intend to pursue either of these two advanced degrees, this requirement can be satisfied with 9 credit hours of School of Design courses.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARC 141 History of Design I ¹	3	ARC 142 History of Design II ¹	3
DF 101 Des. Fundamentals Studio	6	DF 102 Des. Fundamentals Studio	6
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 131 Anly. Geo. and Calculus A ²	4	MA 231 Anly. Geo. and Calculus B ²	3
PE 100 Health and Physical Fitness	1	Physical Education Elective	1
	17		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARC 211 Nat. Systems and Arch.	3	ARC 202 Arch. Design: Environment	6
ARC 263 Profession of Architecture	1	ARC 232 Structures and Materials	3
ARC 400 Architecture Studio ¹	6	ARC 252 Computer Methods in Arch.	3
En. and Behavior Elective ¹	3	Humanities/Soc. Sci. Elect ¹	3
Humanities/Soc. Sci. Elect. ¹	3	Physical Education Elective	1
Physical Education Elective	1		16
	17		

JUNIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
ARC 331 Architectural Structures I	3	ARC 332 Architectural Structures II	3
ARC 400 Architecture Studio ²	6	ARC 302 Arch. Design: Technology	6
Natural Science Elective ¹	4	Humanities Soc. Sci. Elect. ¹	3
Free Elective	3	Natural Science Elective ¹	4
	16		16

SENIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
ARC 400 Architecture Studio ²	6	ARC 402 Arch. Design: History	6
ARC 432 Arch. Construction Systems ²	3	ARC 414 Env. Control Systems ²	3
ARC 441 History of Cont. Arch. ³	3	Free Elective	3
Humanities/Soc. Sci. Elect. ¹	3	Free Elective	3
	15		15

At the completion of four year study (128 credit hours) Bachelor of Environmental Design in Architecture degree is granted. An application to the Fifth Year is required. If accepted to the program:

FIFTH YEAR

ARC 501 Prof. Architecture Studio I	6	ARC 502 Prof. Architecture Studio II	6
ARC 595 Final Project Preparation	3	ARC 561 Practice of Architecture	3
Architecture Elective ⁴	3	Architecture Elective ⁴	3
Architecture Elective ⁴	3	Architecture Elective ⁴	3

Minimum credit hours required for graduation: 158

¹History of Design I and II can be counted towards satisfying humanities requirements. A list of approved courses in natural science and humanities and social sciences is available from the School of Design Registrar. Courses must be selected from that list to meet degree requirements for graduation.

²MA 121 and MA 114 may be substituted for MA 131 and MA 231. MA 111 and other lower level courses are not applicable to the 128 credit hours required for graduation.

³Two of the three ARC 400 Architecture Studios required for graduation may be substituted with design studios in other disciplines represented in the School of Design. No more than one studio may be taken in any semester.

⁴The following is a list of courses that satisfy this requirement: LAR 221 Introduction to Environment and Behavior for Designers, LAR 222 Perception and Behavior for Designers, MDS 201 Environmental Ethics, MDS 303 Humans and the Environment, SOC 203 Current Social Problems, SOC 220 Cultural Geography, SOC (ANT) 261 Technology in Society and Culture.

⁵Not required for the BEDA degree, but required for graduation from Bachelor of Architecture or Master of Architecture degree programs. For those who do not intend to pursue the advanced degrees, these three courses can be replaced by 9 credit hours of other courses in the School of Design.

⁶Must be chosen from 400 or 500 level Architecture courses. A maximum of three courses at 400 level can be taken.

DESIGN

Brooks Hall

Professor W. Taylor, Interim Head of the Department

Alumni Distinguished Undergraduate Professors: C. D. Cox, M. Pause, D. Raymond

Professors: M. Pause, W. Taylor; Professors Emeriti: G. L. Bireline, J. H. Cox, D. R. Stuart; Associate Professors: C. Cox, L. M. Diaz, D. Raymond, B. Schulman, S. Toplikar, S. Wilchins; Assistant Professor: M. Porter

In the Bachelor of Environmental Design degree, design is used as the vehicle for a broadly based, multidisciplinary undergraduate education experience which fully utilizes the range of diverse faculty capabilities. Through flexible curriculum structure and course sequencing, students with a faculty advisor are able to assemble optional learning paths which meet their individual needs. This degree provides an alternative for students who have specific interests and capabilities outside the school's existing degree tracks and students who desire a broader design education taking advantage of the range and diversity of the school's offerings. Those students selecting the Bachelor of Environmental Design degree may wish to use it as a foundation for later graduate study in a specific design discipline.

The Department of Design firmly believes that there is an essential need for students in a research and technically based university to engage in course work that fosters creative thinking. To meet this need, the Department of Design offers a Minor in Design, available to majors in any field. Four specific options are currently available: fibers and surface design, painting, drawing, and sculpture. To complete the minor, 9 hours of prerequisites and 15 hours of specific design courses are required.

The Department of Design also provides a common first year experience for all students entering the School of Design. Design Fundamentals focuses on exposure to basic design concepts and provides a general introduction to the fields of design.

ENVIRONMENTAL DESIGN CURRICULUM

Degree: Bachelor of Environmental Design

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 101 Des. Fundamentals Studio	6	DF 102 Des. Fundamentals Studio	6
DN 381 Basic Drawing	3	ENG 112 Composition and Reading	3
ENG 111 Composition and Rhetoric	3	Humanities/Soc. Sci. Elective	3
Mathematics	3	Mathematics ¹	4
PE 100 Health and Physical Fitness	1	Physical Education Elective	1
	16		17

SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Design Elective	3	Design Elective	3
Humanities/Soc. Sci. Elective ²	3	Humanities/Soc. Sci. Elective ²	3
Natural Science Elective ²	4	Natural Science Elective ²	4
Studio ³	6	Studio ³	6
Physical Education Elective	1	Physical Education Elective	1
	17		17

JUNIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Design Elective	3	Design Elective	3
Design Elective	3	Design Elective	3
Humanities/Soc. Sci. Elective ²	3	Humanities/Soc. Sci. Elective ²	3
Studio ³	6	Studio ³	6
Free Elective	3		15
	18		

SENIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Design Elective	3	Design Elective	3
Design Elective	3	Design Elective	3
Studio ³	6	Humanities/Soc. Sci. Elective ²	3
Free Elective	3	Studio ³	6
	15		15

Minimum credit hours required for graduation: 130*

¹MA 131 and MA 231 may be substituted for MA 121 and MA 114. MA 111 and other lower level Math courses are not applicable to the 130 credit hours required for graduation.

²A list of approved courses in natural science and humanities and social science is available from the School of Design Registrar. Courses must be selected from that list to meet degree requirements for graduation.

³A minimum of six studios from the School of Design offerings are required after the first year. A Focus may be developed in consultation with the student's advisor. The Department of Design offers DN 400, DN 470, and DN 480 studios.

*In order to receive two degrees from the School of Design, a student must complete 30 credit hours above the 130 hour requirement. These 30 hours are to include 18 credits in 400 level studios and 12 credits in design electives in the discipline, beyond those described above. No more than one studio may be taken in any semester.

MINOR IN DESIGN

Before entering into a minor in the Department of Design, students must first complete 9 hours of prerequisite courses which provide an essential foundation in design:

- DF 111—Two Dimensional Design for Non-Design Majors
- DF 112 Three-Dimensional Design for Non-Design Majors
- DN 311—F Drawing

To complete the minor program, students will take 15 hours of design courses, 12 hours of which must be above the 100 level, at least 6 of which must be at the 300 level or above. Four specific options are available in the minor: fibers and surface design, painting, drawing, and sculpture. Courses are chosen from a list of recommended courses in each option in consultation with the adviser. Application forms may be obtained from the department head. Each student will be assigned an adviser consistent with his/her option selection.

GRAPHIC DESIGN

Brooks Hall

Professor M. Davis, *Head of the Department*

Professors: M. Davis, A. Lowrey, Associate Professor; M. Scotford Assistant Professors: K. Bailey, A. Blauvelt, J. Spadaro.

Graphic Design is the process of bringing meaningful visual form to communication. Graphic designers translate communication goals through printed, environmental, and electronic presentations of information and ideas. Graphic designers use words (typography), and images (photographs, illustrations, diagrams, abstract shapes, textures, lines, and color) to express qualitative messages for the purposes of informing, persuading, and inciting to action individuals and audiences who are on the receiving end of communication. Graphic designers are active in all aspects of the communication arts. They design books, magazines, and newspapers as part of the publishing industry. Graphic designers create printed materials, such as annual reports, newsletters, stationery, and collateral literature as part of the effort to establish memorable and cohesive "identities" for institutions, businesses, and government. The designers who work on these projects are employed by advertising agencies, design consulting offices, or by the corporation or government itself as part of an internal communications department. Institutions, such as museums and colleges, employ graphic designers as members of their staffs to design and produce publications, posters, and exhibitions. Graphic designers are also responsible for packaging design, signs in the environment, film titling, television on-air graphics, and computer screen displays and programs.

The Bachelor of Environmental Design in Graphic Design curriculum includes study of the visual, theoretical, and technical aspects of the discipline. The curriculum provides experiences in analysis of communication problems, inventive idea and visual form development, implementation of design strategies, and critical evaluation. Instruction in computer assisted design is integrated within typography, photography, and graphic design studio courses.

GRAPHIC DESIGN CURRICULUM

Degree: Bachelor of Environmental Design in Graphic Design

<i>Fall Semester</i>	FRESHMAN YEAR		<i>Credits</i>
	<i>Credits</i>	<i>Spring Semester</i>	
DF 101 Des. Fundamentals Studio	6	DF 102 Des. Fundamentals Studio	6
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
Humanities Social Sci. Elective	3	Humanities Soc. Sci. Elective	3
Mathematics ¹	3.4	Mathematics ¹	3.4
PE 100 Health and Physical Fitness	1	Physical Education Elective	1
	16 17		16 17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GD 201 Graphic Design Studio	6	GD 202 Graphic Design Studio II	6
GD 212 Photography for Graphic Designers	3	GD 256 Materials and Processes I	3
GD 217 Typography I	3	GD 317 Typography II	3
Natural Science Elective ²	4	Natural Science Elective ²	4
Physical Education Elective	1	Physical Education Elective	1
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GD 301 Graphic Design Studio III	6	GD 400 Adv. Gr. Design Studio ³	6
GD 417 Typography III	3	GD 355 Materials and Processes II	3
GD 242 History of Graphic Design	3	Design Elective	3
Design Elective	3	Humanities/Social Sci. Elective	3
Humanities/Social Sci. Elective	3		
	18		15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GD 400 Adv. Gr. Design Studio ³	6	GD 400 Adv. Gr. Design Studio ³	6
Design Elective	3	Humanities/Soc. Sci. Elective	3
Humanities/Soc. Sci. Elective	3	Free Elective	3
Free Elective	3	Free Elective	3
	15		15

Minimum credit hours for graduation: 130*

¹MA 131 and MA 231 may be substituted for MA 121 and MA 114. MA 111 and other lower level Math courses are not applicable to the 130 credit hours required for graduation.

²A list of approved courses in Natural Sciences and Humanities and Social Sciences is available from the School of Design Registrar. Courses must be selected from these lists to meet degree requirements for graduation.

³A minimum of six (6 credit) studios are required for graduation. Graphic Design majors may elect to take studios in another discipline during the spring semesters of their third and fourth year or may enroll in the Advanced Graphic Design Studio offered that semester. Graphic Design majors must, however, take GD 201, GD 202, and GD 301, and their corequisites (GD 217, 317, 417, 212, 255, and 242), in the sequence prescribed above. No more than one studio may be taken in any semester.

⁴In order to receive two degrees from the School of Design, a student must complete 30 credit hours above the 130 hour requirement. These 30 hours are to include 18 credits in studios and 12 credits in design electives in the discipline.

INDUSTRIAL DESIGN

Brooks Hall

Professor V. M. Foote, FIDSA, Interim Head of the Department

Alumni Distinguished Undergraduate Professor: V. M. Foote

Professors: V. M. Foote, H. Khachatourian; Associate Professors: A. V. Cooke; Adjunct Associate Professors: A. Merino, M. Jones; Assistant Professor: P. Hooper.

Industrial Design is the profession concerned with all the human aspects of machine-made products and their relationship to the environment. The designer is responsible for the planning and design of products. The designer is responsible for the product's human factors engineering, safety, shape, color, texture, maintenance and cost. Industrial design deals with consumer, as well as industrial products. In order to achieve these ends, designers must be involved in three major design and research activities: human behavior, the human-machine relationship, and the product itself.

Areas of design investigation include furniture, housewares, appliances, transportation, tools, farm equipment, medical/electronic instruments, and recreational support equipment.

Graduates with a Bachelor of Environmental Design in Industrial Design have career opportunities in three general areas: corporate design offices in manufacturing companies, independent consulting offices, or governmental agencies.

INDUSTRIAL DESIGN CURRICULUM

Degree: Bachelor of Environmental Design in Industrial Design

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 101 Des. Fundamentals Studio	6	DF 102 Des. Fundamentals Studio	6
DF 141 History of Design I	3	DF 142 History of Design II	3
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
Mathematics ¹	3/4	Mathematics ¹	3/4
PE 100 Health and Physical Fitness	1	Physical Education Elective	1
	16/17		16/17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ID 400 Industrial Design Studio	6	ID 400 Industrial Design Studio	6
ID 255 Cont. Manufacturing Proc I	3	ID 256 Cont. Manufacturing Proc II	3
ID 318 Ideation I	3	ID 318 Ideation II	3
Natural Science Elective ²	4	Natural Science Elective ²	4
Physical Education Elective	1	Physical Education Elective	1
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ID 400 Industrial Design Studio	6	ID 400 Industrial Design Studio	6
ID 415 Microcomputer Imaging	3	Design Elective	3
Design Elective	3	Design Elective	3
Design Elective	3	Humanities/Soc. Sci. Elect. ³	3
Humanities/Soc. Sci. Elect. ³	3		15
	18		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ID 400 Industrial Design Studio	6	ID 400 Industrial Design Studio ³	6
Design Elective	3	Humanities/Soc. Sci. Elective ²	3
Humanities/Soc. Sci. Elective	3	Free Elective	3
Free Elective	3	Free Elective	3
	15		15

Minimum credit hours required for graduation: 130*

¹MA 131 and MA 231 may be substituted for MA 121 and MA 114. MA 111 and other lower level courses are not applicable to the 130 credit hours required for graduation.

²A list of approved courses in natural science and humanities and social science is available from the School of Design Registrar. Courses must be selected from that list to meet degree requirements for graduation.

³A minimum of six 400 series studios are required for graduation. When preregistering, Industrial Design majors may elect to take studios in another design discipline during the spring semesters of their third and/or fourth year, or may enroll in the Industrial Design studio offered that semester. No more than one studio may be taken in any semester.

*In order to receive two degrees from the School of Design, a student must complete 30 credit hours above the 128 hour requirement. These 30 hours are to include 18 credits in 400 level studios and 12 credits in design electives in the discipline, beyond those described above.

LANDSCAPE ARCHITECTURE

Professor A. R. Rice, Head of the Department

Professors: R. Moore, R. R. Wilkinson, D. Wood; Professors Emeriti: R. E. Stipe, E. G. Thurlow; Associate Professors: A. R. Abbate, D. W. Dalton; Assistant Professors: F. Magallanes, S. Raval; Associate Members of the Faculty: W. E. Hooker, J. C. Raulston, M. E. Traer (Horticultural Science), H. Devine (Parks, Recreation and Tourism Management).

Landscape Architecture is the profession concerned with location, design, and development of residential, commercial, institutional, recreational and other community land uses. Preservation and conservation of visual amenities, unique natural areas, and historic

resources are important components of landscape architecture. The student studies history of landscape architecture, planting design, materials and construction, site planning, graphic communication and community design. These subjects are applied to actual design problems in landscape architecture studios.

OPPORTUNITIES

There are approximately 30,000 practicing landscape architects in the U.S. and growth of the profession is projected as among the "Top Ten" by the U. S. Bureau of Labor Statistics. Landscape architects are employed by private firms and by agencies of government such as parks and recreation, forestry, planning and environmental protection. Many pursue graduate degrees, qualifying them for careers in college teaching and more advanced assignments.

LANDSCAPE ARCHITECTURE CURRICULUM

Degree: Bachelor of Environmental Design in Landscape Architecture

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 101 Des. Fundamentals Studio	6	DF 102 Des. Fundamentals Studio	6
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
Mathematics ¹	3/4	Mathematics ¹	3/4
Humanities Soc. Sci. Elective ²	3	Humanities/Soc. Sci. Elective ²	3
PE 100 Health and Physical Fitness	1	Physical Education Elective	1
	16/17		16/17

SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
LAR 400 Landscape Arch. Studio ³	6	HS 211 or 212 Ornamental Plants	3
LAR 433 Native Plants	3	Landscape Concentration ⁴	3
Natural Science Elective	4	Natural Science ⁵	4
Humanities Soc. Sci. Elective ²	3	Humanities/Soc. Sci. Elective ²	3
Physical Education Elective	1	Advised Elective ⁶	3
	17	Physical Education Elective	1
			17

JUNIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
LAR 400 Landscape Arch. Studio ³	6	LAR 400 Landscape Arch. Studio ³	6
LAR 430 Site Planning	3	LAR 457 Const. Materials and Methods	3
LAR 444 (or 332 in Spring) History	3	Humanities Soc. Sci. Elective ²	3
Humanities/Soc. Sci. Elective ²	3	Landscape Concentration ⁴	3
	15	Free Elective	3
			18

SENIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Landscape Concentration ⁴	3	LAR 400 Landscape Arch. Studio ³	6
Landscape Concentration ⁴	3	Humanities/Soc. Sci. Elective ²	3
Advised Elective ⁶	3	Landscape Concentration ⁴	3
Advised Elective ⁶	3	Advised Elective ⁶	3
Free Elective	3	Free Elective	3
	15		15

Minimum credit hours required for graduation: 130*

¹MA 131 and MA 231 may be substituted for MA121 and MA 114. MA 111 and other lower level math courses are not applicable to the 130 credit hours required for graduation.

²A list of approved courses in natural science and humanities and social science is available from the Department. Courses must be selected from that list to meet degree requirements for graduation. The natural science electives must include BS 100 or BO 200, with the second course being selected from SSC 200, MEA 101, MEA 110, or MEA 120.

³A minimum of four 400 level studios are required with a minimum of three of the four being Landscape Architecture. However, one of the LAR 400 studios may be satisfied by HS 400. **No more than one studio may be taken in any semester.**

⁴Landscape Concentration: 12 additional credit hours of professional study are required and may be chosen from a departmental list of selected Landscape Architecture, Horticultural Science, Design, Marine, Earth and Atmospheric Science, or Botany courses.

⁵Advised electives are to be selected in consultation with the student's advisor. Six hours of the required twelve must include courses from within the School of Design.

⁶In order to receive two degrees from the School of Design, a student must complete 30 credit hours above the 130 requirement. These 30 hours are to include 18 credits in 400 level studios and 12 credits in design electives.



COLLEGE OF EDUCATION AND PSYCHOLOGY

Poe Hall

J. J. Michael, *Dean*

B. G. Beezer, *Associate Dean for Academic Affairs*

H. A. Exum, *Associate Dean for Research and External Affairs*

M. A. Weathers, *Director of Teacher Education*

G. S. Martin, *Director of Teaching Fellows Program*

A. P. Smith, *Director of Student Services*

The College of Education and Psychology is concerned with the problems of human development from both psychological and educational perspectives. With emphases upon the preparation of middle grades, secondary, and post-secondary teachers, counselors, supervisors, administrators and psychologists, the college seeks students who are dedicated to the improvement of human beings through education and service and who are sensitive to the complexity of teaching-learning processes. The college is composed of the Departments of Adult and Community College Education, Counselor Education, Curriculum and Instruction, Educational Leadership and Program Evaluation, Mathematics and Science Education, Occupational Education and Psychology.

Undergraduate degree programs are offered in agricultural education, education general studies, health occupations education, marketing education for teachers, mathematics education, science education, technical education, technology education, and psychology. In addition to being admitted to a curriculum, all teacher education candidates must meet program requirements for admission to candidacy in teacher education (including a 2.5 or higher overall grade point average after the sophomore year) and for admission to student teaching (including a 2.5 or higher GPA overall and in one's teaching field).

Graduates of the undergraduate programs in education receive a Bachelor of Science degree in education and normally qualify for an "A" certificate to teach in their chosen field. Graduates of the undergraduate program in psychology receive a Bachelor of Arts in Psychology degree.

Six degree programs (agricultural education, health occupations education, technology education, marketing education, mathematics education and science education lead to certification to teach in grades 9-12. The College of Education and Psychology also offers middle grades degree programs that leads to certification for grades 6-9 with concentrations in language arts, mathematics, science and social studies. Students seeking this certification will graduate with one or two fields of concentration. All teacher education graduates also complete the equivalent of a second major, outside of education.

Professional education courses are provided for those students enrolled in the College of Humanities and Social Sciences who wish to become teachers of secondary English, French, Spanish, and social studies, with certification for grades 9-12. (See the College of Humanities and Social Sciences section of this catalog for information on teacher education options.) Students enrolled in the College of Agriculture and Life Sciences or in science and mathematics departments may double-major in the College of Education and Psychology and also obtain a North Carolina secondary teacher's certificate.

Most of the college's teacher education programs are in fields of teacher shortage. Graduates have little difficulty finding teaching positions. Because of limited faculty resources, space in some programs is limited.

Most of the education and psychology programs listed in the following pages also offer graduate-level curricula. In addition, the College of Education and Psychology has graduate programs in:

Adult & Community College Education	Middle Grades Education
Counselor Education	Occupational Education
Curriculum & Instruction Reading Education	Reading Education
Education Administration	Special Education

(See the *Graduate Catalog* or contact faculty members for information on graduate programs.)

Public school sixth-year (intermediate) certification programs are available in agricultural and occupational education; curriculum and instruction and supervision; administration; counseling; reading education; special education; mathematics and science education; and school psychology. All of the bachelor's level and graduate level certification programs are approved by the North Carolina State Board of Education. Also teacher education programs are accredited by the National Council for the Accreditation of Teacher Education (NCATE).

The modern College of Education and Psychology building is named Poe Hall. It includes a Learning Resources Library, a Center for Learning Technologies, and an Instructional Computing Facility. The building houses laboratories for technology, reading, science, psychology, and guidance and testing activities, as well as a children's play area with an observation room.

SCHOLARSHIPS

The College of Education and Psychology has a scholarship program distinct from the campus Merit Awards Program. Over 20 scholarships are awarded to undergraduates each year, including several scholarships reserved for minority students.

North Carolina State University is one of 13 institutions participating in the N.C. Teaching Fellows Program and has over 200 teaching fellows enrolled. Each fellow receives \$5,000 per year for four years, in exchange for a commitment to teach for four years in the state.

Other students hold the prestigious Paul Douglas Scholarship or receive awards through the State Board of Education's Scholarship Loan Fund for Prospective Teachers and other sources. High school counselors receive information about and applications for all of these scholarships and awards.

SCHOLARS AND HONORS PROGRAMS

The College of Education and Psychology participates in the University Scholars Program, in which selected students each year participate in weekly activities that broaden and deepen their University experiences. The Psychology and Occupational Education Departments offer an optional curriculum for honors students. There is an honors society in Psychology.

INTERNATIONAL ACTIVITIES

Several faculty members have been involved in overseas projects in China, Japan, Peru, Puerto Rico, and Sri Lanka. Some of the foreign language teacher education students spend a year in France or Spain in an exchange program. The enrollment of international students in the several education and psychology programs and elsewhere at NCSU also offers multi-cultural opportunities without one's leaving the campus.

AGRICULTURAL EDUCATION

Poe Hall (602)

Associate Professor L. R. Jewell, Coordinator of Advising

Professor G. E. Moore Associate Professors J. L. Flowers B. M. Kirby.

Agricultural education, in its broadest sense, encompasses areas of study which will enable one to participate effectively in planning, promoting, and initiating educational programs in agriculture. A program leads to a Bachelor of Science degree and is designed to prepare teachers of vocational agriculture in the secondary schools and in technical and community colleges. The demand for agricultural education teachers exceeds present supply. Graduates who obtain certification in the bachelor's program generally have a choice of positions in the Carolinas, Virginia, and throughout the nation.

AGRICULTURAL EDUCATION, TEACHER CERTIFICATION OPTION

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition and Rhetoric	3	ANS 200 Introduction to Animal Science or	
EOE 101 Introduction to Occupational Education	1	BS 100 General Biology	4
MA 111 Precalculus Algebra and Trigonometry	3	ENG 112 Composition and Reading	3
Communication Elective	3	PO 201 Introduction to Poultry Science	3-4
History Elective	3	SOC 202 Principles of Sociology or	
PE 100 Health and Physical Fitness	1	SOC 241 Sociology of Agriculture and Rural	
	14	Society	3
		Math Elective	3
		Physical Education Elective	1
			17 18

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARE 212 Economics of Agriculture or		FOR 252 Introduction to Forest Science	3
BAE 201 Shop Processes and Management	3	SSC 200 Soil Science	4
EC 201 Economics I	3	Agricultural Concentration ¹	3
EOE 207 Introduction to Teaching Occ. Ed	3	Free Elective	3
Agricultural Concentration ²	3-4	Literature Elective	3
Chemistry Elective	4	Physical Education Elective	1
Physical Education Elective	1		17
	17 18		

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EOE 322 Contemporary Vocational Agri.	3	ELP 344 School and Society	3
PSY 304 Educational Psychology	3	PSY 376 Developmental Psychology or	
Agricultural Concentration ¹	4	PSY 476 Psychology of Adolescent Development	3
Agricultural Concentration ²	3-4	SOC 305 Racial and Ethnic Relations	3
Plant Science Elective ³	3	Agricultural Concentration ¹	4
	16 17	Agricultural Specialty ⁴	3
			16

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ECE 451 Improving Reading in Secondary		EOE 424 Planning Educational Programs	3
Schools	2	EOE 427 Student Teaching in Agriculture	8
EOE 426 Methods of Teaching Agriculture	3	EOE 492 Senior Seminar in Agricultural	
Agricultural Concentration ²	4	Education	1
Agricultural Specialty ⁴ or			12
Agricultural Concentration ¹	3-4	Minimum Hours Required for Graduation	127
Free Elective	6		
	17		

¹MA courses above MA 101 or computer science courses.

²These courses are to be selected from one of the seven agricultural concentration areas. See below for specific courses required in each agricultural concentration.

³Select from courses in Botany, Crop Science, Forestry, or Horticulture

⁴These courses, when related to other Ag & Life Science courses, should total a minimum of nine semester hours in a "Specialty" in one selected area of agriculture.

AGRICULTURAL EDUCATION CONCENTRATIONS

<i>Animal Science Concentration (22 hrs)</i>		<i>Credits</i>	<i>Sociology Concentration (24 hrs)</i>	
ANS 200 Introduction to Animal Science	3		ANT 252 Cultural Anthropology	3
ANS 250 Applied Animal Nutrition	3		SOC 202 Principles of Sociology or	
ANS 310 Basic Horse Husbandry	3		SOC 241 Sociology of Agriculture and	
ANS 402 Beef Cattle Management or			Rural Society	3
ANS 404 Dairy Cattle Management	3		SOC 204 Sociology of Family	3
ANS 403 Swine Management or			SOC 205 Work: Occupations & Professions	3
ANS 410 Horse Science	3		SOC 301 Human Behavior	3
GN 301 Genetics in Human Affairs	3		SOC 305 Racial and Ethnic Relations	3
ZO 201 General Zoology	4		SOC 311 Community Relations	3
			SOC 425 Juvenile Delinquency	3
<i>Botany Concentration (26 hrs)</i>			<i>Zoology Concentration (26 hrs)</i>	
BO 200 Plant Life	4		BO 200 Plant Life	4
BO 360 Introduction to Ecology	3		BS 100 General Biology	4
BO 365 Ecology Lab	1		ZO 201 General Zoology	4
BO 400 Plant Diversity	4		ZO 221 Conservation of Natural	
BO 403 Systematic Botany	4		Resources	3
BS 100 General Biology	4		ZO 303 Vertebrate Zoology	3
GN 301 Genetics in Human Affairs	3		ZO 304 Vertebrate Zoology Lab	1
ZO 221 Conservation of Natural Resources	3		ZO 353 Wildlife Management	3
			ZO 360 Introduction to Ecology	3
			ZO 365 Ecology Lab	1
<i>Economics Concentration (24 hrs)</i>			NON-CERTIFICATION OPTION*	
ARE 212 Economics of Agriculture or			<i>Speech Communication Concentration (24 hrs)</i>	
EC 201 Economics I	3		AC 311 Communication Methods & Media	3
ARE 303 Farm Management	3		AC 470 Agricultural Communications	3
ARE 306 Agricultural Law or			COM 110 Public Speaking	3
BUS 307 Business Law I	3		COM 201 Theory of Persuasive Communication	3
ARE 311 Agricultural Markets	3		COM 226 Introduction to Public Relations	3
ARE 415 Farm Appraisal and Finance	3		COM 326 Public Relations Applications	3
BUS 313 Marketing Methods	3		COM 446 Problems in Public Relations	3
EC 475 Comparative Economic Systems	3		COM 456 Organizational Communication	3
Economics Elective	3			
<i>Horticultural Science Concentration (24 hrs)</i>			*Students who select the Speech Communication Concentration will not be eligible for Teacher Certification in North Carolina.	
BO 200 Plant Life	4			
HS 201 Principles of Horticulture	3			
HS 301 Plant Propagation	4			
HS 371 Interior Landscapes	3			
HS 411 Nursery Management	3			
HS 431 Vegetable Production	4			
HS 440 Greenhouse Management	3			

AGRICULTURAL EXTENSION CONCENTRATION

The Agricultural Education/Agricultural Extension curriculum is designed to prepare individuals for extension agent positions. It is offered as a program track under the existing Bachelor of Science degree in Agricultural Education. Students are required not only to engage in classroom and laboratory studies on the North Carolina State University campus, but also to engage in a closely supervised practicum in the field. Students will be required to complete a 45-hour field work experience in an extension office during their sophomore year and a full-semester practicum experience in an extension office or agricultural related industry during their senior year.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition and Rhetoric	3	BS 100 General Biology	4
EOE 101 Introduction to Occupational Education	1	ENG 112 Composition and Reading	3
MA 111 Precalculus Algebra and Trigonometry	3	Agricultural Elective ¹	3
History Elective	3	Math Elective ²	3.4
Speech Elective	3	Social Science Elective ³	3
PE 100 Health and Physical Fitness	1	Physical Education Elective	1

14

17 18

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BAE 201 Shop Processes and Management	3	ARE 212 Economics of Agriculture or	
CH 100 Chemistry and Society or		EC 201 Economics I	3
PY 211 College Physics I	4	EOE 226 Applications of Instructional Tech.	
EOE 307 Field Work in Occupational Education ..	3	in AED	3
Humanities Elective ¹	3	FOR 202 Introduction to Forest Science	3
Literature Elective	3	FS 201 Introduction to American Government ..	3
Physical Education Elective	1	Animal Science or Poultry Science Elective ² ..	3-4
	17	Physical Education Elective	1
			16-17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
AC 311 Communication Methods & Media	3	EOE 323 Leadership Development in Agriculture ..	3
ARE 303 Farm Management	3	PSY 304 Educational Psychology	3
SOC 202 Principles of Sociology or		Agricultural Specialty ³	3-4
SOC 241 Sociology of Agriculture and		Plant Science Elective ⁴	3
Rural Society	3	Free Elective	3
SSC 323 Water Management	3	Free Elective	3
Agricultural Specialty ⁴	3-4		
	15-16		18-19

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EAC 478 Extension as Non-Formal Education	3	EOE 422 Public Relations in Agriculture	3
EOE 426 Methods of Teaching Agriculture	3	EOE 423 Practicum in Agricultural	
Agricultural Elective ⁵	3	Extension/Industry	8
Agricultural Specialty ⁶	3-4	EOE 492 Senior Seminar in Agricultural	
Agricultural Specialty ⁶	3-4	Education	1
Free Elective	3		12
	18-20	Minimum Hours Required for Graduation	127

¹Select from Group "C" Agricultural Applied Science and Technology courses.

²MA courses above MA 111 or computer science.

³Select from University list of courses approved as social sciences.

⁴Select from University list of courses approved as humanities.

⁵Select from Group "C" Agricultural Applied Science and Technology courses in Animal Science or Poultry Science.

⁶These four courses, when related to other Ag & Life Sc courses, would total a minimum of 12 semester hours in a "Specialty" in one selected area of agriculture.

⁷Select from courses in Botany, Crop Science, Forestry, or Horticulture.

EDUCATION, GENERAL STUDIES

Poe Hall (Room 608)

Associate Professor R. C. Serow, Coordinator of Advising

The Education: General Studies program has two areas of emphasis. Emphasis A serves those students who are interested in those fields of education that do not require formal certification, such as juvenile homes, day care, and other public and private agencies. Emphasis B serves those students previously enrolled in teacher education programs at North Carolina State University, but whose career goals have changed.

REQUIREMENTS

	<i>Credits</i>
GENERAL STUDIES	
<i>Communication Skills</i>	9
English composition (ENG 111, 112)	
Communication (one course)	
<i>Humanities</i>	18
History (two courses)	
Fine Arts (at least one course)	
Literature (English or American; two courses)	
Philosophy (PHI 205)	

<i>Social Sciences</i>	12
Political Science or Economics (two-course sequence)	
Psychology (PSY 200)	
Sociology (SOC 202)	
<i>Natural Sciences</i>	7-8
Includes at least one laboratory course	
<i>Mathematics</i>	6-7
One mathematics course and an elective from mathematics, statistics, or computer science; but not MA 101 and MA 111	
<i>Physical Education</i>	4
PE 100 Health & Physical Fitness	
Three one credit activity courses	
<i>Electives</i>	12
	68-70
MAJOR	
<i>Core Courses:</i>	
Introductory Course	3-4
EOE 101 and 365*, or 101 and 322*, or EMS 203, or ECI 205	
ELP 201 Alternative Education Agencies	3
ELP 344 School and Society	3
PSY 304 Educational Psychology	3
PSY 376, 475, or 476	3
	15-16
<i>Emphasis A</i>	
(Noncertified position in education or related occupations)	
COM 112 Interpersonal Communication	3
Philosophy Elective	3
PSY 310 or 320	3
SOC 305 and 311	6
SOC 418 Sociology of Education	3
ELP 496 Special Topics in Education General Studies	3
Restricted Electives (An approved sequence in ED or PSY)	21
	42
<i>Emphasis B</i>	
(Transfer from teacher certification to general studies program without certification)	
Teaching field	30
Supporting courses	9
Education Elective	3
	42
Minimum Hours Required for Graduation	126

*These courses must be taken in sequence, with a total of 4 credits.

ENGLISH TEACHER EDUCATION

Professor L. H. MacKethan, Coordinator of Advising

Students desiring to become secondary English teachers in grades 9-12 will be enrolled in the College of Humanities and Social Sciences. In that college's section of this catalog, curriculum requirements for the teacher education option can be found under "English". Students desiring to become language arts teachers in grades 6-9 will be enrolled in the College of Education and Psychology. For details, consult the "Middle Grades Education" description.

FRENCH TEACHER EDUCATION

Assistant Professor L. Salstad, Coordinator of Advising

Lecturer D. Adler, Assistant Coordinator of Advising

Students desiring to become teachers of French will be enrolled in the College of Humanities and Social Sciences. In that college's section of this catalog, curriculum requirements for the teacher education option in French can be found under "Foreign Languages and Literatures."

GRAPHIC COMMUNICATIONS

Poe Hall (510)

Lecturer G. K. Hilliard, Jr., Coordinator, Graphic Communications

Assistant Professor: W. J. Vanderwall; Visiting Assistant Professor: B. Rogers; Assistant Professor Emeritus: J. L. Crow; Lecturers: M. Batchelor, T. J. Branoff, J. F. Freeman, A. Y. Scales, E. N. Wiebe; Lecturer Emeritus: B. D. Webb.

A 15-hour minor is offered in Graphic Communications. The minor is designed to develop proficiency in selecting and applying graphic techniques in both career and leisure activities, to provide in depth manual and computer graphics skills, and to enrich visual perception and critical thought in graphic areas. For additional information, consult the Graphic Communications Program, 510 Poe Hall.

HEALTH OCCUPATIONS TEACHER EDUCATION

Poe Hall (Room 502)

Associate Professor D. Akroyd, Coordinator of Advising

Assistant Professor B. Richards

The Health Occupations Education program goal is to provide learning experiences that permit students to develop specific competencies associated with effective teaching and leadership roles as they relate to health care. The Bachelor of Science program prepares qualified individuals for various positions in hospitals, secondary schools, community colleges, and other post-secondary institutions. Some graduates seek teaching positions in their own health fields; others choose to teach high school health occupations education. Some work in health care delivery in area hospitals and health agencies, while others work in a variety of capacities in business, industry, and government. Thirty hours of equivalency credit is granted by validation of a current credential in a health occupations specialty recognized by the American Dental Association, American Medical Association Committee on Allied Health Education and Accreditation, National League for Nursing, or Council on Professional Accreditation.

HEALTH OCCUPATIONS EDUCATION CURRICULUM

FRESHMAN YEAR

All health occupations students transfer into the curriculum. Generally most have 30 semester hours or more of transfer credit.

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
EOE 101 Introduction to Occupational Education ..	1	PSY 376 Developmental Psychology, or	
MA Elective (except 101)	3	PSY 476 Psychology of Adolescent Development ...	3
PSY 304 Educational Psychology	3	ZO 212 Basic Anatomy and Physiology	4
Humanities Social Science Electives	3	Humanities Social Science Elective	3
Free Elective	3	MA Elective (except 101), Logic	
		or Statistics	3
	16		16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EOE 331 Health Professions	3	EOE 332 Health Promo. & Disease Prev.	3
EOE 335 Plan Classroom & Clinical Curr.	3	EOE 333 Health Care Delivery	3
EOE 338 Medical Law & Ethics	3	EOE 336 Strategies of Teaching a Health Occ. ...	3
Literature Elective	3	Communication Elective	3
Natural Science Elective (BS 100 or 105)	4	Humanities Social Science Elective	3
	16		15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EOE 433 Health Occupations Specialty		EOE 434 Clin. Supervis. in Health Occ.	3
Practicum	3	EOE 437 Health Occ. Teach. Practicum	8
EOE 436 Evaluative Skills of Teaching a		Free Elective	3
Health Occupation	3		14
Humanities Social Science Elective	3		
History Elective	3	Minimum hours required for graduation	124
Free Elective	3		
	15		

TECHNICAL EDUCATION

Poe Hall (Room 502)

The curriculum in technical education prepares instructors in a range of technologies. A strong mathematics and physics foundation is required. A student enrolling in the technical education curriculum may specialize in areas related to his/her technical preparation and/or previous work experience. Admission to the technical education curriculum is limited to students demonstrating proficiency in a given applied technology, i.e., electrical, electronics, mechanical, etc. Thus, the program is not open to high school graduates, who lack technical preparation and/or experience. Employment opportunities for technical education graduates include teaching in community and technical colleges and within industry as technical trainers and coordinators of training programs.

REQUIREMENTS

<i>Major Field of Study</i>	<i>Credits</i>
GC 120 Foundations of Graphics Communications	3
GC 200 Applied Computer Aided Drawing	3
EOE 301 Survey of Vocational Education	3
Technical Education Elective	3
Approved Electives	15

27

Professional Education

ECI 483 Introduction to Media and Instructional Technology	3
EOE 452 Lab Planning in Technology Education	3
EOE 101 Introduction to Occupational Education	1
EOE 365 Trade Analysis in Course Development	3
EOE 466 Methods of Teaching Vocational Industrial and Technical Education	3
EOE 467 Student Teaching Vocational Industrial and Technical Education	8
EOE 481 Introduction to Development Training	3
EOE 496 Senior Seminar in Industrial and Technical Education	3
	<hr/>
	27

English Courses

ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
	<hr/>
	6

Mathematics Courses

MA 111 Precalculus Algebra and Trigonometry (credits do not count toward graduation)	3
MA 141 Analytic Geometry and Calculus I	4
MA 241 Analytic Geometry and Calculus II	4
	<hr/>
	11

Humanities and Social Science Courses

EC 201 Economics I	3
PS 201 Introduction to American Government	3
PSY 304 Educational Psychology	3
SOC 202 Principles of Sociology	3
SOC 205 Work: Occupational & Professional	3
Communication Elective	3
History Elective	3
Humanities Elective	3
Literature Elective	3
	<hr/>
	27

Physical and Biological Sciences

CH 101 General Chemistry I	4
PY 205 Physics for Engineers and Scientists I or PY 211 College Physics I	4
PY 208 Physics for Engineers and Scientists II or PY 212 College Physics II	4
	<hr/>
	12

Physical Education and Free Electives

PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Free Electives	12
	<hr/>
	16

¹Approved electives must be selected from engineering, engineering sciences, or physical sciences and related to student's specialization.

²Students required to demonstrate proficiency in an applied technology (may be fulfilled by technical school training) prior to admission to the program.

MARKETING EDUCATION FOR TEACHERS

Poe Hall (Room 502)

Associate Professor T. O'Brien, Coordinator of Advising

The Marketing Education curriculum is specifically designed to prepare teachers for Marketing Education programs in secondary schools. In addition, it provides the necessary pedagogical and technical preparation needed by marketing instructors in community and technical colleges, as well as for selected training and development roles in business and industry. The combination of a broad general and professional education, business and marketing courses, and supervised work experience in marketing jobs provides a unique preparation for educators in a rapidly expanding occupational area.

MARKETING EDUCATION FOR TEACHERS CURRICULUM

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EOE 101 Introduction to Occupational Education ..	1	CSC 200 Introduction to Computers and Their Uses	3
EOE 241 Foundations of Marketing Education	2	ENG 112 Composition and Reading	3
ENG 111 Composition and Rhetoric	3	MA 114 Intro. to Finite Mathematics	3
MA 111 Precalculus Algebra and Trigonometry	3	w Applications	3
PE 100 Health and Physical Fitness	1	History Elective	3
Natural Science Elective	4	Speech Elective	3
	14	Physical Education Elective	1
			16

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EC 201 Economics I	3	EC 202 Economics II	3
EOE 207 Introduction to Teaching Occ Ed**	3	EC 313 Marketing Methods	3
Literature Elective	3	EOE 307 Field Work in Occupational Education ..	2
Natural Science Elective	4	PSY 304 Educational Psychology**	3
Physical Education Elective	1	SOC 202 Principles of Sociology	3
Free Elective	3	Political Science Elective	3
	17	Physical Education Elective	1
			18

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EB(ST) 350 Economics & Business Statistics	3	ACC 280 Managerial Accounting	3
EOE 346 Curriculum and Methods of Teaching MKE**	3	EB 307 Business Law I	3
ELP 344 School and Society**	3	BUS 330 Human Res. Management	3
PSY 376 Developmental Psychology or PSY 476 Psychology of Adolescent Development ..	3	BUS 467 Adv. and Sales Promotion*	3
BUS 466 Sales Management*	3	EOE 307 Field Work in Occupational Education ..	1
	15	PHI 314 Issues in Business Ethics	3
			16

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BUS 468 Marketing Mgmt. and Plan.*	3	EOE 447 Student Teaching in Marketing Education	8
EB 460 Marketing Research	3	EOE 494 Senior Seminar in Marketing Education	3
ECI 451 Improving Reading in the Secondary Schools	2	Free Elective	3
EOE 444 Administration of Marketing Education ..	3		14
Economics & Business Elective (300 or 400 level)	3	Minimum Hours Required for Graduation ..	127
Free Elective	3		
	17		

*Taken at Meredith College through the Cooperating Raleigh Colleges agreement

**Prerequisites to the Professional Semester

MATHEMATICS AND SCIENCE EDUCATION

Poe Hall (Room 326)

Professor J. R. Kolb, *Head of the Department*

Alumni Distinguished Undergraduate Professors: N. D. Anderson, J. R. Kolb, L. W. Watson

Professors: N. D. Anderson, L. M. Clark, J. R. Kolb; *Professor Emeritus:* H. E. Speece; *Associate Professors:* L. V. Stiff, W. M. Waters, Jr., L. W. Watson, J. H. Wheatley; *Associate Professor Emeritus:* H. A. Shannon; *Assistant Professors:* K. S. Norwood, J. C. Park, S. L. Westbrook; *Adjunct Assistant Professors:* R. R. Jones, C. M. Meek, W. E. Spooner.

The Department of Mathematics and Science Education prepares undergraduate students to become teachers of mathematics and science. The department traditionally prepares competent professionals who have strong subject matter backgrounds and pedagogical skills. Departmental majors may seek certification for teaching secondary grades 9-12

or middle grades 6-9. Students interested in teaching in the middle grades may select from mathematics or science as single concentrations, or a mathematics/science dual concentration earning double certification. Students in the 9-12 secondary curriculum in mathematics or science education may complete a double major and receive a second degree in mathematics or one of the sciences. All of the programs provide a broad background in the natural sciences, social sciences and humanities; depth in mathematics or an area of science; and the development of professional competencies.

SCHOLARSHIPS AND AWARDS

The Speece Scholarship is awarded annually to as many as three outstanding juniors or seniors in either mathematics education or science education. The department sponsors a Mathematics and Science Education Club and recognizes the Outstanding Graduate in Mathematics Education and Outstanding Graduate in Science Education annually.

MATHEMATICS EDUCATION CURRICULUM (Grades 9-12 Certification)

Coordinator: J. R. Kolb

Requirements

General Studies (54-57 semester hours)	Credits
<i>English and Communication Courses</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
Communication Elective	3
	9
<i>Humanities and Social Sciences Courses¹</i>	
History Elective	3
Humanities Electives	6
Literature Elective	3
Social Science Electives	9
	21
<i>Science Courses</i>	
Physical Science Elective	8
Natural Science Elective	3-4
	11-12
<i>Physical Education and Free Electives</i>	
PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Free Electives ²	9-12
	13-16
Teaching Major (43-46 semester hours)	
<i>Core Courses (required of all students)</i>	
E 115 Introduction to Computing Environment	1
CSC 110 Introduction to Programming	3
MA 141 Analytic Geometry and Calculus I	4
MA 225 Structure of the Real Number System <i>or</i> CSC(MA) 222 Applied Discrete Mathematics ³	3
MA 241 Analytic Geometry and Calculus II	4
MA 242 Analytic Geometry and Calculus III	4
MA 408 Foundations of Euclidean Geometry	3
PHI 201 Logic	3
ST 101 Statistics by Example	3
	28

Specializations (choose one of these)

<i>Mathematics</i>	
MA 341 Applied Differential Equations I	3
MA 403 Introduction to Modern Algebra	3
MA 405 Introduction to Linear Algebra and Matrices	3
MA 433 History of Mathematics	3
Math Elective ¹	3
	<hr/> 15
<i>Computer Science</i>	
CSC 210 Programming Concepts	3
CSC 201 Basic Computer Organization and Assembly Language	3
CSC 311 Data Structures	3
MA 403 Introduction to Modern Algebra	3
MA 305 Elementary Linear Algebra or	
MA 405 Introduction to Linear Algebra and Matrices	3
CSC Elective	3
	<hr/> 18
<i>Statistics</i>	
MA 305 Elementary Linear Algebra or	
MA 405 Introduction to Linear Algebra and Matrices	3
MA 403 Introduction to Modern Algebra	3
ST 301 Statistical Methods I	3
ST 302 Statistical Methods II	3
ST 421 Introduction to Mathematical Statistics I	3
ST 422 Introduction to Mathematical Statistics II	3
	<hr/> 18
Professional Studies (required of all students) (31 semester hours)	
ECL 451 Improving Reading in the Secondary Schools	2
ELP 344 School and Society	3
EMS 101 Orientation to Mathematics and Science Education	0
EMS 203 Introduction to Teaching Mathematics and Science	3
EMS 470 Methods and Materials for Teaching Mathematics ²	3
EMS 471 Student Teaching in Mathematics ³	8
EMS 472 Teaching Mathematics Topics in Senior High ⁴	3
EMS 480 Teaching Mathematics with Microcomputers	3
PSY 304 Educational Psychology	3
PSY 476 Psychology of Adolescent Development	3
	<hr/> 31
Minimum Hours Required for Graduation	131

¹The humanities and social science electives must be chosen from the university's official list of courses. Many courses in philosophy, religion, literature, fine arts, history, and foreign language are approved humanities courses. Many courses in economics, sociology, anthropology, political science, psychology, and geography are approved social science courses. Specified courses in other areas such as communication, education, design, and multidisciplinary studies also are approved as humanities or social sciences. Students are encouraged to select courses in this curriculum area so that each of these areas is represented; economics, governmental systems, and fine arts.

²Must be a two course sequence, with a laboratory, in chemistry or physics.

³May be in biological sciences, physical sciences, or marine, earth and atmospheric sciences.

⁴Students in the mathematics specialization are required to take 12 hours, while those in computer science and statistics are required to take 9 hours.

⁵MA 225 is required in all specializations except Computer Science.

⁶Mathematics elective must be at 200 level or above, or MA 105.

⁷These courses are taken together as a block and completed prior to student teaching. Student teaching is full-time for ten weeks during the fall semester.

SCIENCE EDUCATION CURRICULUM (Grades 9-12 Certification)

Coordinator: J. H. Wheatley

REQUIREMENTS

General Studies (37-39 semester hours)

<i>English and Communication Courses</i>	<i>Credits</i>
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
Communication Elective	3
	<hr/> 9

<i>Humanities and Social Sciences Courses¹</i>	
History Elective	3
History or Philosophy of Science Elective	3
Humanities Elective	3
Literature Elective	3
Social Science Electives	6
	<hr/>
	18

<i>Physical Education and Free Electives</i>	
PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Free Electives	6-8
	<hr/>
	10-12

**Specialization (59-63 semester hours)
Biology (59-62)**

<i>Specialization Courses</i>	
BO 200 Plant Life	4
BO 380 Introduction to Ecology	3
BO 385 Ecology Laboratory	1
BS 100 General Biology	4
CH 220 Introductory Organic Chemistry or CH 221 Organic Chemistry I	4
GN 301 Genetics in Human Affairs or GN 411 Principles of Genetics	3-4
MB 401 General Microbiology or BCH 451 Introductory Biochemistry	3-4
ZO 201 General Zoology	4
ZO 421 Principles of Physiology or ZO 414 Cell Biology or BO 421 Plant Physiology	3-4
	<hr/>
	29-32

<i>Supporting Courses</i>	
CH 101/121 General Chemistry I	4
CH 107/127 Principles of Chemistry	4
MA 131 Analytic Geometry & Calculus A or MA 121 Elements of Calculus	4
MA 231 Analytic Geometry & Calculus B or ST 311 Introduction to Statistics	3
MEA 101/110 Geology I: Physical	4
PY 211 College Physics I	4
PY 212 College Physics II	4
Earth Science Elective	3
	<hr/>
	30

Chemistry (60-62)

<i>Specialization Courses</i>	
CH 101/121 General Chemistry I	4
CH 107/127 Principles of Chemistry	4
CH 221 Organic Chemistry I	4
CH 223 Organic Chemistry II	4
CH 315 Quantitative Analysis	4
CH 331 Intro. Physical Chemistry	4
CH 401 Systematic Inorganic Chemistry or BCH 451 Introductory Biochemistry	2-3
	<hr/>
	26-27

<i>Supporting Courses</i>	
BS 100 General Biology	4
MA 141 Analytic Geometry & Calc. I	4
MA 241 Analytic Geometry and Calc. II	4
MA 242 Analytic Geometry & Calc. III	4
MEA 101/110 Geology I: Physical	4
PY 205 Physics for Engrs. & Sci. I	4
PY 208 Physics for Engrs. & Sci. II	4
Biological Science Elective	3-4
Earth Science Elective	3
	<hr/>
	34-35

Earth Sciences (59-61)

<i>Specialization Courses</i>	
MEA 101/110 Geology I: Physical	4
MEA 102/111 Geology II: Historical	4
MEA 130 Intro. to Weather & Climate or MEA 311 Physical Climatology	3
MEA 200 Introduction to Oceanography	3
MEA 330 Environmental Geology	3
MEA 331 Optical Mineralogy	2
MEA 451 Structural Geology	4
PY 223 Astronomy	3
Earth Science Elective	3
	<hr/>
	29

Supporting Courses

BS 100 General Biology	4
CH 101/121 General Chemistry I	4
CH 107/127 Principles of Chemistry	4
MA 131 Analytic Geometry & Calc. A and MA 231 Analytic Geometry & Calc. B. or MA 141 Analytic Geometry & Calc. I and MA 241 Analytic Geometry & Calc. II	7-8
PY 211 College Physics I	4
PY 212 College Physics II	4
Biological Science Elective	3-4
	<hr/>
	30-32

Physics (61-63)*Specialization Courses*

PY 201 University Physics I and PY 202 University Physics II or PY 205 Physics for Engrs. & Scientists I and PY 208 Physics for Engrs. & Scientists II	8
PY 223 Astronomy	3
PY 203 University Physics III or PY 407 Intro. to Modern Physics	3-4
Physics Electives [†]	10
	<hr/>
	24-25

Supporting Courses

BS 100 General Biology	4
CH 101/121 General Chemistry I	4
CH 107/127 Principles of Chemistry	4
MA 141 Analytic Geometry & Calc. I	4
MA 241 Analytic Geometry & Calc. II	4
MA 242 Analytic Geometry & Calc. III	4
MA 341 Applied Differential Equations	3
MEA 101/110 Geology I: Physical	4
Biological Science Elective	3-4
Earth Science Elective	3
	<hr/>
	37-38

Professional Studies (29 semester hours)

ECL 451 Improved Reading in Secondary Schools	2
ELP 344 School and Society	3
EMS 203 Introduction to Teaching Mathematics and Science	3
EMS 475 Methods of Teaching Science [‡]	3
EMS 476 Student Teaching in Science [‡]	8
EMS 477 Instructional Materials in Science	2
EMS 495 Senior Seminar in Mathematics & Science	2
PSY 304 Educational Psychology	3
PSY 476 Psychology of Adolescent Development	3
	<hr/>
	29

Minimum Hours Required for Graduation 130

[†]The humanities and social science electives must be chosen from the university's official list of courses. Many courses in philosophy, religion, literature, fine arts, history, and foreign language are approved humanities courses. Many courses in economics, sociology, anthropology, political science, psychology, and geography are approved social science courses. Specified courses in other areas such as communication, education, design, and multidisciplinary studies also are approved as humanities or social sciences. Students are encouraged to select courses in this curriculum area so that each of these areas is represented: economics, governmental systems, social systems, and fine arts.

[‡]PY 411, 413, 414, and 452 are recommended.

[‡]These courses are taken together as a block and completed prior to student teaching. Student teaching is full-time for ten weeks in the fall semester.

MIDDLE GRADES EDUCATION

Associate Professor C. L. Harper, Coordinator

Associate Professors: J. F. Arnold, R. J. Pritchard; Assistant Professors: P. L. Marshall, C. A. Pope

The Middle Grades Education program seeks to prepare teachers who can effectively instruct adolescents and be responsive to their unique needs, interests, and abilities. Graduates earn certification for teaching in grades 6-9 in two subject disciplines: language arts and social studies. Students specializing in middle grades mathematics/science are enrolled in and advised by the Department of Mathematics and Science Education.

LANGUAGE ARTS AND SOCIAL STUDIES EDUCATION— DUAL CONCENTRATION (6-9 Certification)

REQUIREMENTS

General Studies (50 semester hours)	Credits
<i>English and Communication Courses</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
Communication Elective	3
	9
<i>Natural Sciences Courses</i>	
Two courses of laboratory science	8
<i>Mathematics Courses</i>	
One mathematics course and an elective from mathematics, computer science or statistics but excluding MA 101 and MA 111	6
<i>Humanities and Social Science Courses</i>	
HI 205 Western Civilization Since 1400 or	
HI 233 The World in the 20th Century	3
HI 251 Early American History or	
HI 252 Modern American History	3
American Literature Electives	6
Anthropology or Sociology Elective	3
Economics Elective	3
Political Science Elective	3
	21
<i>Physical Education Courses</i>	
PE 100 Health and Physical Fitness	1
PE 280 Emergency Medical Care and First Aid or	
PE 285 Personal Health	2
Three one-credit PE electives	3
	6
Free Electives (9 semester hours)	
Professional Education (40 semester hours)	
ECI 102 Orientation to Middle Grades Education	0
ECI 205 Introduction to Teaching Humanities and Social Sciences	3
ECI 306 Middle Years Reading	3
ECI 309 Teaching in the Middle Years	3
ECI 415 The Arts and Adolescence	3
ECI 416 Teaching Exceptional Students in the Mainstreamed Classroom	3
ECI 430 Methods & Materials for Teaching Language Arts in the Middle Grades	4
ECI 435 Methods & Materials for Teaching Social Studies in the Middle Grades	4
ECI 454 Student Teaching in English/Language Arts	4
ECI 464 Student Teaching in Social Studies	4
ELP 344 School and Society	3
PSY 304 Educational Psychology	3
PSY 476 Psychology of Adolescent Development	3
	40

Teaching Concentrations (30 semester hours)

<i>Language Arts</i>	
ECI 307 Teaching Writing Across the Curriculum	3
ECI(ENG) 405 Literature for Adolescents	3
ENG 262 English Literature II	3
ENG 322 Advanced Composition and Rhetoric or	
ENG 324 Modern English	3
Literature Elective	3
<i>Under General Studies and Professional Education</i>	
ECI 306 Middle Years Reading	3
American Literature courses	6
Communication Elective	3
<i>Social Studies</i>	
GEO 200 Principles of Teaching Geography	3
HI 275 Introduction to History of South and East Africa or	
HI 276 Introduction to History of West Africa	3
HI 364 History of North Carolina	3
EC Elective	3
HI Elective	3
<i>Under General Studies</i>	
HI 205 West. Civ. Since 1400 or	
HI 223 The World in the 20th Century	3
HI 251 Early American History or	
HI 252 Modern American History	3
Anthropology or Sociology Elective	3
Political Science Elective	3
Minimum Hours Required for Graduation	129

Note: Students should consult the Department of Curriculum and Instruction for detailed information as to which courses will satisfy program requirements.

**MATHEMATICS AND SCIENCE EDUCATION—DUAL CONCENTRATION
(Grades 6-9 Certification)**

Coordinator: J. R. Kolb

REQUIREMENTS

General Studies (43 semester hours)	Credits
<i>English and Communication Courses</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
Communication Elective	3
	9
<i>Humanities and Social Sciences Courses¹</i>	
History Elective	3
Humanities Electives	6
Literature Elective	3
Social Science Electives	9
	21
<i>Physical Education and Free Electives</i>	
PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Free Electives	9
	13
Teaching Major (46-48 semester hours)	
BS 100 General Biology	4
CH 101/121 General Chemistry I	4
CH 107/127 Principles of Chemistry	4
CSC 101 Introduction to Programming or	
CSC 200 Introduction to Computers & Their Uses	3
MA 114 Introduction to Finite Mathematics & Applications	3
MA 131 Analytic Geometry & Calc. A and	
MA 231 Analytic Geometry & Calc. B or	
MA 141 Analytic Geometry & Calc. I and	
MA 241 Analytic Geometry & Calc. II	7-8

MA 225	Structure of the Real Number System or	3
MA 403	Introduction to Modern Algebra	3
MA 408	Foundations of Euclidean Geometry	3
MEA 101	Geology I: Physical	3
MEA 110	Geology I Laboratory	1
Statistics Elective or		
MA 105	Mathematics of Finance	3
PY 221	College Physics	5
Life Science Elective		3-4
		<hr/>
		46-48
Professional Studies (39 semester hours)		
ECl 306	Middle Years Reading	3
ECl 309	Teaching in the Middle Years	3
ECl 415	Arts and Adolescence	2
ELP 344	School and Society	3
EMS 203	Introduction to Teaching Mathematics and Science	3
EMS 470	Methods and Materials for Teaching Mathematics ²	3
EMS 471	Student Teaching in Mathematics ²	4
EMS 474	Teaching Mathematics Topics in the Middle Years ²	3
EMS 475	Methods of Teaching Science ²	3
EMS 476	Student Teaching in Science ²	4
PE 280 Emergency Medical Care and First Aid or		
PE 285	Personal Health	2
PSY 304	Educational Psychology	3
PSY 476	Psychology of Adolescent Development	3
		<hr/>
		39
Minimum Hours Required for Graduation		128

¹The humanities and social science electives must be chosen from the university's official list of courses. Many courses in philosophy, religion, literature, fine arts, history, and foreign language are approved humanities courses. Many courses in economics, sociology, anthropology, political science, psychology, and geography are approved social science courses. Specified courses in other areas such as communication, education, design, and multidisciplinary studies also are approved as humanities or social sciences. Students are encouraged to select courses in this curriculum area so that each of these areas is represented: economics, governmental systems, social systems, and fine arts.

²These courses are taken together as a block and completed prior to student teaching. Student teaching is full-time for ten weeks in the fall semester.

MATHEMATICS EDUCATION CURRICULUM (Grades 6-9 Certification)

Coordinator: K. S. Norwood

REQUIREMENTS

General Studies (54 semester hours)		<i>Credits</i>
<i>English and Communication Courses</i>		
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
Communication Elective		3
		<hr/>
		9
<i>Humanities and Social Sciences Courses¹</i>		
History Elective		3
Humanities Electives		6
Literature Elective		3
Social Science Electives		9
		<hr/>
		21
<i>Science Courses</i>		
Physical Science ²		4
Natural Science Elective ²		4
		<hr/>
		8
<i>Physical Education and Free Electives</i>		
PE 100	Health and Physical Fitness	1
Physical Education Electives		3
Free Electives		12
		<hr/>
		16

Teaching Major (36 semester hours)	
E 115 Introduction to Computing Environments	1
CSC 110 Introduction to Programming	3
CSC 200 Introduction to Computers and Their Uses	3
MA 105 Mathematics of Finance	3
MA 114 Introduction to Finite Mathematics with Applications	3
MA 141 Analytic Geometry & Calc. I	4
MA 241 Analytic Geometry & Calc. II	4
MA 225 Structure of the Real Number System or MA 403 Introduction to Modern Algebra	3
MA 408 Foundations of Euclidean Geometry	3
MA 433 History of Mathematics	3
PHI 201 Logic	3
Statistics Elective	3
	36
Professional Studies (39 semester hours)	
ECI 306 Middle Years Reading	3
ECI 309 Teaching in the Middle Years	3
ECI 415 The Arts and Adolescence	2
ELP 344 School and Society	3
EMS 101 Orientation to Mathematics and Science Education	0
EMS 203 Introduction to Teaching Mathematics and Science	3
EMS 470 Methods & Materials for Teaching Mathematics	3
EMS 471 Student Teaching in Mathematics ¹	8
EMS 474 Teaching Mathematics Topics in the Middle Grades ²	3
EMS 480 Teaching Mathematics with Microcomputers	3
PE 280 Emergency Medical Care and First Aid or PE 285 Personal Health	2
PSY 304 Educational Psychology	3
PSY 476 Psychology of Adolescent Development	3
	39
Minimum Hours Required for Graduation	129

¹The humanities and social science electives must be chosen from the university's official list of courses. Many courses in philosophy, religion, literature, fine arts, history, and foreign language are approved humanities courses. Many courses in economics, sociology, anthropology, political science, psychology, and geography are approved social science courses. Specified courses in other areas such as communication, education, design, and multidisciplinary studies also are approved as humanities or social sciences. Students are encouraged to select courses in this curriculum area so that each of these areas is represented: economics, governmental systems, social systems, and fine arts.

²Physical Science must be a course in either chemistry or physics, with a laboratory.

³May be a course in either biological science, physical sciences, or marine, earth and atmospheric sciences, with a laboratory.

⁴The courses are taken together as a block and completed prior to student teaching. Student teaching is full time for ten weeks during the fall semester.

SCIENCE EDUCATION CURRICULUM (Grades 6-9 Certification)

Coordinator: J. C. Park

REQUIREMENTS

General Studies (53-54 semester hours)		<i>Credits</i>
<i>English and Communication Courses</i>		
ENG 111 Composition and Rhetoric		3
ENG 112 Composition and Reading		3
Communication Elective		3
		9
<i>Humanities and Social Sciences Courses</i>		
Literature Elective		3
History Elective		3
Humanities Electives		9
Social Science Electives		9
		24
<i>Mathematics Courses</i>		
MA 121 Elements of Calculus or MA 131 Analytic Geometry and Calculus A		4
MA 231 Analytic Geometry and Calculus B or ST 311 Introduction to Statistics		3.4
		7.8

<i>Physical Education and Free Electives</i>	
PE 100 Health and Physical Fitness	1
Physical Education Electives	3
Free Electives	9
	13
Teaching Major (38 semester hours)	
BO 200 Plant Life	4
BS 100 General Biology	4
CH 101/121 General Chemistry I	4
CH 107/127 Principles of Chemistry	4
MEA 101/110 Geology I: Physical	4
ZO 201 General Zoology	4
Earth Science Elective	3
PY 211 College Physics I and	
PY 212 College Physics II or	
PY 221 College Physics and	
Physics Elective	8
Science Elective	3
	38
Professional Studies (38 semester hours)	
ECl 306 Middle Years Reading	3
ECl 309 Teaching in the Middle Years	3
ECl 415 Arts and Adolescence	2
ELP 344 School and Society	3
EMS 203 Introduction to Teaching Mathematics and Science	3
EMS 475 Methods of Teaching Science ²	3
EMS 476 Student Teaching in Science ²	8
EMS 477 Instructional Materials in Science ²	2
EMS 495 Senior Seminar in Mathematics and Science Education	2
PE 280 Emergency Medical Care and First Aid or	
PE 285 Personal Health	2
PSY 304 Educational Psychology	3
PSY 476 Psychology of Adolescent Development	3
	37
Minimum Hours for Graduation	128

¹The humanities and social science electives must be chosen from the university's official list of courses. Many courses in philosophy, religion, literature, fine arts, history, and foreign language are approved humanities courses. Many courses in economics, sociology, anthropology, political science, psychology, and geography are approved social science courses. Specified courses in other areas such as communication, education, design, and multidisciplinary studies also are approved as humanities or social sciences. Students are encouraged to select courses in this curriculum area so that each of these areas is represented: economics, governmental systems, social systems, and fine arts.

²These courses are taken together as a block and completed prior to student teaching. Student teaching is full time for ten weeks during the fall semester only.

PSYCHOLOGY

Poe Hall (Room 640)

Professor D. W. Martin, Head of the Department and Coordinator of Advising

Alumni Distinguished Undergraduate Professors: K. W. Klein, D. H. Mershon, S. S. Snyder

Professors: J. W. Cunningham, D. W. Drewes, T. E. LeVere, J. W. Kalat, D. H. Mershon, S. E. Newman, F. J. Smith, P. W. Thayer, B. W. Westbrook; Adjunct Professors: J. L. Howard, W. Turnow; Professors Emeriti: K. L. Barkley, H. M. Carter, J. C. Johnson, H. G. Miller; Associate Professors: L. E. Baker-Ward, R. W. Barnes-Nacoste, W. P. Erchal, D. O. Gray, A. G. Halberstadt, T. M. Hess, P. F. Horan, K. W. Klein, J. E. R. Luginbuhl, S. B. Pond, S. S. Snyder, N. W. Walker; Adjunct Associate Professors: B. F. Corder, A. D. Hall; Associate Professors Emeriti: J. L. Cole, M. H. Pitts, R. F. Rawlis; Assistant Professors: C. C. Brookins, S. A. Converse, M. E. Haskett, M. A. Wilson, M. S. Wogalter; Adjunct Assistant Professors: M. Y. Bingham, B. H. Bieth, B. A. Braddy-Burrus, J. W. Fleenor, C. L. Kronberg, B. H. Rogers; Associate Members of the Faculty: C. D. Korte (Multidisciplinary Studies), R. G. Pearson (Industrial Engineering), J. L. Wasik (Statistics)

Psychology is one of the basic university disciplines. Mastery of some of the knowledge in psychology is necessary to practitioners in education, health, social service, social sciences and managerial professions. Students holding the bachelor's degree in psychology and wishing to apply their psychological studies in a professional capacity generally continue

their education in a graduate program such as applied or experimental psychology, or in such fields as law, medicine, business, social work and a variety of other fields. Students in psychology may also choose to enter business or government, often without further training beyond the bachelor's degree. There are currently two different programs for undergraduate majors in psychology: the General Option (PSY), and the Human Resource Development Option (HRD). Each program emphasizes different aspects of the study of psychology. The following sections provide separate descriptions of these programs and their current requirements.

Within each of the options, there are honors tracks which provide special curricula and an opportunity for work with faculty on research projects. Students must have completed a minimum of 45 semester hours of course work (at least 15 at NCSU) and have a grade point average of 3.25 or better to be considered for admission to an honors program. More details as to admission and requirements are available from the Psychology Department.

All undergraduate majors are members of the Psychology Club, which provides a number of enrichment activities, including sponsorship of the Carolinas Psychology Conference. One of the largest undergraduate conferences in the United States, it is held annually in cooperation with Meredith College and other Cooperating Raleigh Colleges. There is also an active chapter of Psi Chi, the national psychology honor society, which provides enrichment to the program.

PSYCHOLOGY: GENERAL OPTION

The General Option is oriented toward the student who wants a broad understanding of the types of problems with which psychology is concerned and the ways in which psychologists approach and attempt to solve these problems. Curriculum requirements in the General Option are sufficiently flexible for students to concentrate, if they wish, in another area of study as well as psychology, and thereby prepare themselves for a variety of careers or professional programs. By wise choice of elective courses, a student can prepare for medical, legal, business, or education graduate training, while at the same time acquiring a basic background in the social sciences.

REQUIREMENTS

<i>Major Field of Study</i>	<i>Credits</i>
PSY 200 Introduction to Psychology	3
PSY (ST) 240 Intro. Research Methods I	3
PSY (ST) 241 Intro. Research Methods I Lab	1
PSY (ST) 242 Intro. Research Methods II	3
PSY (ST) 243 Intro. Research Methods II Lab	2
Two Courses from Group I	6
PSY 300 Perception	
PSY 310 Learning and Motivation	
PSY 320 Cognitive Processes	
PSY 330 Biological Psychology	
PSY 505 History and Systems of Psychology	
Three courses (one each from three different sets in Group 2)	9
PSY 307 or 340 Industrial Psychology or Ergonomics	
PSY 376, 475 or 476 Developmental Psychology	
PSY 370 or 470 Personality and Abnormal Psychology	
PSY 411 or 412 Social or Applied Psychology	
PSY 435 Introduction to Psychological Measurement	
PSY Electives	6
	33
<i>English Courses:</i>	
ENG 111, 112 English Composition	6
ENG 331, 332 or 333; or COM 110, 112, 201, or 202	3
	9
<i>Mathematical Courses:</i>	
Two mathematics courses (not MA 101 or 109)	6-7
One computer science course	2-3
	8-10

<i>Humanities and Social Science Courses:</i>	
Two literature courses	6
Three history or social science courses	9
PHI 201, 311, 332, 335 or 340	3
One other philosophy course	3
	21
<i>Natural Science Courses:</i>	
BS 100 or 106	4
Two natural science courses (at least one with lab)	5-7
	10-11
<i>Restricted Electives:</i>	
Five courses in an approved grouping related to student's future plans	15
<i>Free Electives:</i>	
To meet minimum total hours required for graduation	21-24
<i>Physical Education:</i>	
PE 100 Health & Physical Fitness	1
Three courses	3
Minimum Hours Required for Graduation	124
Students should consult the Psychology Department for detailed information as to which courses will satisfy mathematics, natural science, literature and social science requirements.	
Required PSY—Group 1: two courses from PSY 300, 310, 320, 330, 350	
Required PSY—Group 2: one course from any three sets	
PSY 307 or 340	
PSY 376, 475 or 476	
PSY 370 or 470	
PSY 411 or 412	
PSY 438	

MINOR IN COGNITIVE SCIENCE

The Departments of Psychology and of Philosophy and Religion offer an interdisciplinary minor in cognitive science. The minor provides a general introduction to contemporary interdisciplinary research within the framework of the "computer model" mind, and offers the student the opportunity for in-depth study of selected topics such as the nature of human information processing, the acquisition and use of language, and machine intelligence.

To complete the minor, 15 hours are required, distributed as follows: PSY 320 (Cognitive Processes); PSY 340 (Ergonomics) or PSY 545 (Human Information Processing); PHI 331 (Philosophy of Language); PHI 332 (Philosophy of Psychology); PHI (PSY) 425/525 (Introduction to Cognitive Science).

MINOR IN PSYCHOLOGY

The Psychology Department offers a minor in psychology to majors in any field except psychology. To complete the minor, eighteen hours of courses are required, six of these hours in the basic science of psychology, and nine in the applied aspects of psychology. PSY 200 is a required prerequisite. All must be passed with a grade of "C" or better.

PSYCHOLOGY: HUMAN RESOURCE DEVELOPMENT OPTION

The Human Resource Development (HRD) Option is designed to provide a groundwork of skills and experience for students who wish to enter human service careers with a B.A. degree. With appropriate curriculum modifications, the program can also provide a sound background for students who wish to go into advanced degree programs in psychology, management, personnel, social work, counseling, guidance, education, and other areas. Students interested in graduate school should confer with their advisors in order to plan an appropriate course of study.

The HRD Option focuses on enabling students to gain direct experience in the areas in which they would like to work. HRD students devote a semester to learning principles and skills related to working with human problems, and subsequently each HRD student

spends a semester working part-time or full-time in a job related to his/her own area of interest. The HRD Option accepts a maximum of 20 students each year. Interested students can apply for admissions to HRD during their sophomore or junior year. Further information and application forms are available in the Psychology Department office.

REQUIREMENTS

<i>Major Field of Study</i>	<i>Credits</i>
PSY 200 Introduction to Psychology	3
PSY (ST) 240 Intro. Research Methods I	3
PSY (ST) 241 Intro. Research Methods I Lab	1
PSY (ST) 242 Intro. Research Methods II	3
PSY (ST) 243 Intro. Research Methods II Lab	2
PSY 210 Applied Psychology or	
PSY 412 Applied Psychological Research	3
PSY 350 HRD Skills	3
PSY 495 HRD Practicum	6-11
PSY 499 Individual Study in Psychology	4
PSY Electives	9
	37-42
<i>English Courses:</i>	
ENG 111, 112 English Composition	6
COM 112 and one of ENG 331, 332, 333, COM 110, 201, or 202	6
	12
<i>Mathematics Courses:</i>	
Two mathematics courses (not MA 101 or 109)	6-7
One computer science course	2-3
	8-10
<i>Humanities and Social Science Courses:</i>	
Two literature courses	6
Three history or social science courses	9
PHI 201, 311, 332, 335 or 340	3
One other philosophy course	3
	21
<i>Natural Science Courses:</i>	
BS 100 or 105	4
Two natural science courses (at least one with lab)	6-7
	10-11
<i>Restricted Electives:</i>	
Three courses in an approved grouping related to student's future plans	9
<i>Free Electives:</i>	
As needed to meet minimum hours required for graduation	15-21
<i>Physical Education:</i>	
PE 100 Health & Physical Fitness	1
Three courses	3
	4
Minimum Hours Required for Graduation	124

Students should consult the Psychology Department for detailed information as to which courses will satisfy mathematics, natural science, literature and social science requirements.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 or 105 General Biology	4	ENG 112 Composition & Reading	3
ENG 111 Composition & Rhetoric	3	History or Social Science	3
PSY 200 Intro. to Psychology	3	Natural Science	3-4
PE 100 Health and Physical Fitness	1	Philosophy	3
Mathematics	4	Free Elective	3
	15	Physical Education Elective	1
			16-17

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PSY 210 Intro Behavioral Research I	3	PSY 242 Intro Behavioral Research II	3
PSY 241 Intro Behav oral Res I Lab	1	PSY 243 Intro Behavioral Res II Lab	2
History or Social Science	3	Computer Science	2-3
Literature	3	History or Social Science	3
Mathematics	3-4	Natural Science	3-4
Physical Education in Elective	1	Philosophy	3
	14-15	Physical Education Elective	1
			17-19

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
COM 112 Interpersonal Communication	3	PSY 495 HRD Practicum	3-8
PSY 210 Applied Psychology	3	PSY 499 Individual Study in Psychology	4
PSY 412 Applied Psychology Research	3	PSY Elective	3
PSY 350 HRD Skills	3	Free Elective	3-6
PSY 195 HRD Practicum	3		16-18
Restricted Elective	3		
Free Elective	3		
	18		

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Literature	3	PSY Elective	3
PSY Elective	3	Restricted Elective	3
Restricted Elective	3	Communication or Technical Writing	3
Free Elective	6	Free Electives	3-6
	15		12-15
		Minimum Hours Required for Graduation	124

SOCIAL STUDIES TEACHER EDUCATION

Associate Professor R. C. Brisson, Coordinator of Advising (Sociology)

Associate Professor J. A. Mulholland, Coordinator of Advising (History)

Professor J. P. Mastro, Coordinator of Advising (Political Science)

Students desiring to become secondary social studies teachers in grades 9-12 will be enrolled in the College of Humanities and Social Sciences. Curriculum requirements for the teacher education options can be found under "History," "Political Science and Public Administration," and "Sociology and Anthropology" in that college's section. Students desiring to become social studies teachers in grades 6-9 will be enrolled in the College of Education and Psychology.

SPANISH TEACHER EDUCATION

Assistant Professor L. Salstad, Coordinator of Advising

Students desiring to become teachers of Spanish will be enrolled in the College of Humanities and Social Sciences. The curriculum requirements for the teacher education option in Spanish can be found under "Foreign Languages and Literatures" in that college's section.

TECHNOLOGY EDUCATION

Poe Hall (Room 502)

Associate Professor R. E. Peterson, *Coordinator of Advising*

Associate Professors: W. W. DeLuca, W. J. Haynie, III, R. E. Wenig.

Technology education is a curriculum that studies the materials, processes, and products of technology and industry. Students learn safe and efficient use of tools, machines, and the characteristics of materials in various technology education labs. Products are designed and constructed and systems of efficiently organized work are studied. Practical skills and an understanding of the contributions and impacts of technology in society are developed. The Technology Education curriculum provides a general technical background for a variety of employment opportunities including certification as a teacher for industrial arts and technology programs in middle and high schools and a non certification option for those who seek entry into business and industry. A minor in technology education is available.

TECHNOLOGY EDUCATION CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition and Rhetoric	3	CSC 200 Intro. to Computers	3
EOE 101 Introduction to Occupational Ed.	1	ENG 112 Composition and Reading	3
GC 120 Foundations of Graphic Comm.	3	HI 341 Technology in History	3
TED 115 Wood Processing	3	TED 122 Metal Technology	3
Math Elective	3	Physical Education Elective	1
Physical Education Elective	1	Restricted Elective*	3
	14		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EOE 207 Intro. to Teach Occ. Ed.	3	TED 221 Construction Technology	3
GC 200 Applied Computer Aided Drawing	3	TED 246 Graphic Arts Technology	3
Chemistry Elective	4	Physical Education Elective	1
Literature Elective	3	Physics Elective	4
Physical Education Elective	1	Restricted Elective*	3
Restricted Elective*	3	Restricted Elective*	3
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ELP 344 School and Society	3	PSY 376 Developmental Psychology, or	
PSY 304 Educational Psychology	3	PSY 476 Psychology of Adolescent Development ..	3
TED 359 Electrical Technology I	3	TED 360 Electrical Technology II	3
Free Elective	3	TED 384 Computer Applications in Industry	3
Restricted Elective*	3	Communication Elective	3
Restricted Elective*	3	Restricted Elective*	3
	18	Restricted Elective*	3
			18

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ECE 451 Improving Reading in the Sec. Schools ..	2	EOE 452 Lab Planning in Technology Ed	3
EOE 456 Curriculum and Methods in Tech. Ed. ..	3	EOE 457 Student Teaching in Technology Ed. ..	8
TED 430 Manufacturing Technology	3	EOE 495 Senior Seminar in Technology Ed	3
TED 476 Transportation Technology	3		14
Free Elective	3		
Free Elective	3	Minimum Hours Required for Graduation	131
	17	(128 in some options)	

*Restricted Electives must be selected from an approved concentration of courses in either Communications, Economics, or Multidisciplinary Studies. See your advisor for additional information.

TECHNOLOGY EDUCATION, Non-Certification Option

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
GC 120 Foundations of Graphic Comm.	3	HI 341 Technology in History	3
TED 115 Wood Processing	3	TED 122 Metal Technology	3
Education Elective	3	Math Elective	3
Math Elective	3	Free Elective	3
PE 100 Health and Physical Fitness	1	Physical Education Elective	1
	16		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 200 Introduction to Computers and Their Uses	3	EC 201 Intro. to Economics	3
GC 200 Applied Computer Aided Drawing	3	TED 221 Construction Technology	3
Chemistry Elective	4	TED 246 Graphic Arts Technology	3
Humanities/Social Science Elective	3	Communications (Humanities) Elective	3
Literature Elective	3	Physical Education Elective	1
Physical Education Elective	1	Physics Elective	4
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BUS 360 Marketing Methods	3	EC 310 Managerial Economics	3
PS 201 Introduction to American Government or		TED 360 Electrical Technology II	3
PSY 304 Educational Psychology	3	TED 384 Computer Applications in Industry	3
TED 359 Electrical Technology I	3	Communication Elective	3
Advised Technical Elective	3	Psychology Elective	3
Science Elective	3	Free Elective	3
Free Elective	3		18
	18		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ELP 344 School & Society	3	EOE 307 Field Work in Occupational Education	6
TED 430 Manufacturing Technology	3	EOE 452 Technology Education	3
TED 476 Transportation Technology: Energy and Power	3	EOE 495 Senior Seminar in Technology Education	3
Advised Technical Elective	3		12
Free Elective	3		15
	15	Minimum Hours Required for Graduation	129

MINOR IN TECHNOLOGY EDUCATION

The Technology Education minor provides students a blend of cognitive and psychomotor experiences that enhance the understanding of technology and allow development of fundamental skills in selected technical areas. Each student will select courses with the aid of an advisor from the Technology Education faculty. The minor requires a Graphic Communications course, fundamentals courses, and applications courses. The minor option allows students to pursue professional interests within an area of technology.

COLLEGE OF ENGINEERING

Page Hall (Rooms 118 and 120)

W. L. Meier, Jr., *Dean*

T. H. Glisson, *Associate Dean for Academic Affairs*

W. E. Isler, *Associate Dean for Research Programs*

R. M. Turner, *Assistant Dean for Student Services*

H. Winston, *Assistant Dean for Academic Affairs*

Students who seek a challenging technical career in research and development, design, construction, production, maintenance, technical sales, management, teaching, or other careers requiring a methodical, creative solution of problems, should consider an engineering or computer science education. At NCSU, the College of Engineering has a distinguished and internationally recognized faculty. The faculty, together with the curricula of the undergraduate and graduate programs, offer an opportunity for ambitious students to become the leaders and prime movers of our increasingly technological world. Because of the great influence of science and technology on our everyday lives, today's engineer and computer scientist must be acutely aware of, and responsible for, the impact that his or her creations may have on society. In addition to safety, aesthetics, economics, and energy, today's technologist must consider environmental, sociological, and other "human concern" costs.

The college's 29,000 graduates may be found in widely diversified careers throughout the world. Most are practicing in the engineering profession, but because their education has equipped them well to deal with problems in a wide variety of fields, many College of Engineering graduates have become corporate presidents, leaders in government, lawyers, and medical doctors, to name a few.

The College of Engineering is organized into ten departments: Biological and Agricultural, Chemical, Civil, Electrical and Computer, Industrial, Materials Science and Engineering, Mechanical and Aerospace, Nuclear, and Textile Engineering and Science; and the Department of Computer Science. Sixteen undergraduate degree programs are offered in these ten departments. In addition, a degree program in Engineering is offered by special arrangement to the very few students who can clearly demonstrate the need for an individualized program of study. All departments also offer advanced studies leading to professional degrees, master's degrees and the Doctor of Philosophy degree. (See listing of graduate degrees offered.)

The College of Engineering requests and receives accreditation from the Engineering Accreditation Commission of the Accrediting Board for Engineering and Technology (ABET) for twelve of its undergraduate engineering degree programs. The program in computer science is accredited by The Computer Science Accreditation Commission (CSAC) of the Computing Sciences Accreditation Board (CSAB). Accreditation insures that these programs satisfy requirements for acceptance by these nationally recognized agencies. All curricula and programs are designed to maintain the college's national and international reputation while meeting the needs of the people and industries of the state and region through effective instruction, competent research, and the development of new and meaningful contributions to scientific knowledge.

A Career Planning and Placement Center is maintained by the University to assist continuing students and graduating students to achieve their career goals.

UNDERGRADUATE CURRICULA AND DEGREES

Entering students receive assistance in planning an appropriate program of study and have available continued guidance from academic advisors throughout their academic careers. Beginning freshmen are enrolled in the Engineering Undesignated program for one to two years. After successfully completing Engineering Undesignated requirements,

a student may be admitted to a specific department. In order to be eligible to apply for admission into a degree program, Engineering Undesignated students must successfully complete at least 28 credit hours, including the following courses: MA 141 and MA 241; PY 205; ENG 111; E 115; CH 101, and one of either CH 107 or CSC 110/112.

Prerequisite requirement for all engineering courses Before a student in the College of Engineering may enroll in a 200 or higher level engineering course, the student must have earned a grade of "C" or higher in ENG 111, MA 141, MA 241, PY 205, and CH 101, and the student must have successfully completed E 115, and one of either CH 107, CSC 110, or CSC 112.

Bachelor of Science The baccalaureate program provides preparation for entry into industry, government, business or private practice as well as graduate school. Graduates with a BS degree in Engineering or Computer Science may be engaged in design development, production, construction, sales, maintenance, or the planning, operation or management of industrial units.

The undergraduate curricula offer programs of study leading to bachelor's degrees in aerospace engineering, biological and agricultural engineering, chemical engineering, civil engineering, civil engineering construction option, construction management, computer engineering, computer science, electrical engineering, engineering, environmental engineering, industrial engineering, industrial engineering furniture manufacturing option, materials science and engineering, mechanical engineering, nuclear engineering, and textile engineering. Graduation requirements include completion of one of the sixteen curricula with an overall grade point average of 2.0 and a grade point average of 2.0 in the major courses. The total number of required credits ranges from 120 to 135 semester hours.

ENGINEERING SCHOLARS PROGRAM

The **Engineering Scholars Program** has as its goal the promotion of research and academic careers in engineering and computer science. Under the sponsorship of the College of Engineering, in cooperation with the Division of Student Affairs, scholars begin by living together and participating in special educational seminars, cultural enrichment activities, and special scholars' sections in some courses. In the sophomore year, Engineering Scholars may begin research apprenticeships with faculty members throughout the College of Engineering. Additional information may be obtained by contacting departmental program representatives.

DOUBLE DEGREE PROGRAMS

NCSU students may wish to earn Bachelor of Science degrees in two fields of engineering or in computer science and an engineering field. When the two courses of study are planned early and carefully, a number of courses can simultaneously satisfy requirements in both degrees. Humanities, social science, physics, mathematics, chemistry, English and physical education sequences are common to most curricula. In addition, required courses in one curriculum can sometimes be used as electives in another field. A well-planned double degree program can be completed in five years. Students interested in such a program should consult the Assistant Dean for Student Services.

Other students may wish to combine a Bachelor of Science in Engineering or Computer Science with a Bachelor of Science or Bachelor of Arts degree in another college or school at NCSU. Here also, a number of courses required for one degree may satisfy requirements for a second degree. When the two courses of study are planned early and carefully, a double-degree program can be completed in as few as five years. Students interested in such a program should contact the Assistant Dean for Student Services.

Benjamin Franklin Scholars Program

A limited number of freshmen in the College of Engineering are selected to participate in the Benjamin Franklin Scholars program. In addition to their major courses, each Benjamin Franklin Scholar develops an individualized, five-year plan of work focused on a central theme in the humanities and social sciences. Students completing the program

receive a Bachelor of Science in an engineering discipline or computer science and a Bachelor's degree in multidisciplinary studies.

This double-degree program provides a unique opportunity to integrate a solid base of knowledge in technology or science with a broad philosophical perspective of the humanities. The curriculum for the double degree program has four main components: (1) a strong general education, (2) specially designed interdisciplinary and problem-defining courses, (3) all technical course requirements associated with the engineering or computer science degree, and (4) a thirty hour multidisciplinary concentration designed by the student in consultation with his or her advisors. With careful planning, this program can be completed in five years.

For more information, contact the Assistant Dean for Academic Affairs in the College of Engineering (118 Page Hall), or the Assistant Dean for Undergraduate Affairs in the College of Humanities and Social Sciences (106 Caldwell Hall).

TRANSFER PROGRAM

Students with non engineering degrees or one or more years of academic work completed at other institutions may apply for transfer admission to the College of Engineering through the University Admissions Office. Students are admitted from appropriate programs from four-year institutions, as well as junior and community colleges.

Students currently attending or anticipating attendance at other institutions are advised to contact the Assistant Dean for Student Services for information regarding admission to NCSU, credit for courses taken elsewhere, and the like.

PROFESSIONAL DEGREES IN ENGINEERING

The College of Engineering offers post-baccalaureate curricula leading to the degrees of Chemical Engineer, Civil Engineer, Electrical Engineer, Industrial Engineer, Materials Engineer, Mechanical Engineer, and Nuclear Engineer. These programs of study are designed to fit the needs of students desiring intensive specialization in a particular field, or additional work not ordinarily covered in the normal undergraduate curricula. For further details, see "Professional Degrees."

PURCHASE OF COMPUTERS BY COLLEGE OF ENGINEERING STUDENTS

During their first semester, new freshmen in the College enroll in a computer literary course, E 115, which is taught using the EOS student computing facility. Following completion of E 115, it is expected that students will incorporate use of EOS workstations into all curricular areas, including the preparation of reports and papers in non-technical subjects. In either the freshman or sophomore year, most students will take a course in computer programming and thereafter, will increasingly use computers as an engineering tool. The College policy is that all of its students will be provided with the computing resources required to successfully complete their course of study. However, some students may find that owning a computer is beneficial in terms of convenience and ready access to computational capability. Since different departments within the College have different course and computer language requirements, the College recommends that new students who decide to purchase a personal computer should not do so until they have been admitted into a degree program.

INTERNATIONAL OPPORTUNITIES

The College is actively working to provide its students with opportunities for overseas work and study experience. In addition to the study abroad program which is available to all students at NCSU, College of Engineering students can participate in an exchange program with the University de Technology de Compiegne in Compiegne, France. Alternatively, through the College of Textiles, students interested in France can participate in an exchange program at the Catholic University of Lille, France. Students interested in Japan can participate in one of several programs offered by EAGLE, the Engineering Alliance for Global Education.

HUMANITIES AND SOCIAL SCIENCES

Each student in the College of Engineering is required to take a minimum of 18 credit hours of humanities and social science courses. All of the courses used to satisfy the humanities and social science requirement must be taken from the College of Engineering list of approved courses. The courses will be distributed as designated below:

1. A beginning economics course, EC 201 or ARE 212.
2. A course in the history of science or the philosophy of science. Suitable courses are shown on the following list.
 - HI 321 Ancient and Medieval Science
 - HI 322 Rise of Modern Science
 - HI 341 Technology in History
 - HI(MDS) 445 History of American Technology
 - HI 480 History of the Scientific Revolution
 - HI 481 History of the Life Sciences
 - HI 482 Darwinism in Science and Society
 - MDS 301 Science and Civilization
 - MDS 302 Contemporary Science and Human Values
 - MDS 304(495B) Ethical Dimensions of Progress
 - MDS 402 Peace and War in a Nuclear Age
 - MDS 403 Seminar in Technology and Society
 - MDS 405 Technology and American Culture
 - PHI 340 Philosophy of Science
3. Two courses, at least one of which must be an advanced course, from one of the following humanities groups.
 - Communication (COM)
 - English Language Literature (ENG)
 - Foreign Language Literature (FL, GRK, LAT)
 - History (HI)
 - Science, Technology, and Values (MDS)
 - Philosophy (PHI)
 - Religion (REL)
4. Two courses, at least one of which must be an advanced course, from one of the following social science groups.
 - Anthropology (ANT)
 - Economics (EC)
 - Science, Technology, and Society (MDS)
 - Political Science (PS)
 - Psychology (PSY)
 - Sociology (SOC)

Note: The beginning economics course specified in (1) may be used with an advanced economics course to satisfy the social science requirement (4) above. If so, an additional course must be completed and any course from the College of Engineering list of approved humanities and social science courses may be used for this purpose. Students should obtain a copy of the list from their Coordinator of Advising.

COOPERATIVE EDUCATION PROGRAM

This optional program is structured so that the student will alternate semesters of study with semesters of practical work as sophomores and juniors. The freshman and senior years are spent on campus, while sophomore and junior academic work is spread over a three year period to permit alternating academic semesters with work-experience semesters. Students earn a salary while they are in industry, and they may earn a sufficient income to finance much of their college education. The co-op plan can be completed in five years, during which time the student receives 12 to 18 months of industrial experience.

Students in all curricula in the College of Engineering may apply for the co-op program if they have a grade point average of 2.25 or better. After a student has been accepted for employment, he or she is expected to maintain at least a 2.0 grade point average. Application for admission into the co-op program should be made early in the spring semester of the

freshman year; however, later applications resulting in fewer work semesters prior to graduation will be considered during the sophomore year or the first semester of the junior year. Engineering Undesignated students must be admitted into an engineering degree program prior to beginning the first co-op assignment. Further information may be obtained from the Office of Cooperative Education, 212 Peele Hall.

STUDENT ACTIVITIES

Each curriculum in the College of Engineering has a technical society open to every student enrolled in the curriculum. In most cases, these are student chapters of national professional organizations. Each curriculum also has one or more honor societies to give recognition to students who have earned superior academic records. In addition, there are college-wide honor, professional, and service societies that offer personally and educationally rewarding opportunities for students.

Student representatives of each curriculum serve on the Engineers' Council. The Council is the coordinating agency for college-wide activities such as the Engineering Fundamentals Examination review classes, the Engineers' Week Exhibition, the annual St. Patrick's Day Dance, and the *N. C. State Engineer* student publication.

BIOLOGICAL AND AGRICULTURAL ENGINEERING

(Also see Agriculture and Life Sciences.)

David S. Weaver Laboratories (Room 100)

Professor D. B. Beasley, Head of the Department

Professor C. F. Abrams, Jr., Graduate Administrator

Professor J. H. Young, Coordinator of Advising

(For a list of faculty, see Agriculture and Life Sciences.)

Biological and agricultural engineering "brings engineering to life". Students analyze and develop solutions to unique engineering problems of biological and agricultural systems. An area of concentration can be chosen whereby scientific and engineering principles are applied to such diverse problem areas as: biomechanical systems for biomedical applications; proper environmental management of soil and water resources; processing and marketing of food and fiber; and machines, controls, and structures for biological and agricultural systems.

OPPORTUNITIES

Conceptualizing, designing, and developing systems for producing, processing and packaging a high quality food supply and maintaining a high quality environment will provide many opportunities for graduates of the biological and agricultural engineering curriculum. Jobs can be in design, development and research in public institutions and in industry. Examples are food engineers for food processing companies, biological engineers for biomedical engineering, design engineers for farm equipment companies, and environmental engineers for government environmental agencies, industry or engineering consulting firms. This curriculum, accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, also provides adequate training for post-graduate work leading to advanced degrees in Biological and Agricultural Engineering.

CURRICULUM IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

The curriculum provides an educational program for students which uniquely prepares them for dealing with engineering problems in the biological and agricultural areas. Flexibility in the program allows the student to choose electives which may lead to concentrations in the areas of: (1) biological engineering, (2) environmental/soil and water engineering, (3) food engineering, (4) power and machinery engineering, or an emphasis area designed by the student and his/her advisor. Emphasis is placed on basic science and engineering courses such as mathematics, physics, chemistry, mechanics, biology, soils, and thermodynamics which provide a sound background for the application of engineering to agricultural and biological problems.

The program is jointly administered by The College of Engineering and The College of Agriculture and Life Sciences in order to assure quality of basic training in both engineering and the life sciences. Undergraduate freshmen entering this curriculum should enroll in the College of Engineering undesignated program and indicate BAU as their curriculum choice. After successfully completing the Engineering undesignated requirements the student will enter the Biological and Agricultural Engineering Department (BAE). Graduates receive a B.S. in Biological and Agricultural Engineering.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Chem. Principles & Appl.	3
CH 121 General Chemistry I Lab	1	CH 127 Chem. Prin. & Appl. Lab	1
E 100 Introduction to COE	0	ENG 112 Composition & Reading	3
E 115 Intro. to Computing Envr.	1	MA 241 Analyt. Geom. & Calculus II	4
ENG 111 Composition & Rhetoric	3	PY 205 Physics for Engrs. & Sci. I	4
MA 141 Analyt. Geom. & Calculus I	4	Physical Education Elective	1
Human./Social Sci. Elec.	3		
PE 100 Health and Physical Fitness	1		
	16		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BAE 101 Intro. to BAE & Comp.	4	BAE 202 Intro. to BAE Methods	4
CE 214 Engr. Mech. Statics or		BS 100 General Biology	4
MA 242 Analyt. Geom. & Calculus III	4	CE 215 Engr. Mech. Dynamics or	
MAE 206 Engr. Statics	3	CH 220 Organic Chemistry or	
PY 208 Physics for Engrs. & Sci. II	4	SSC 200 Soil Science	4
Human./Social Sci. Elec.	3	MA 341 Applied Differ. Equa.	3
	18	MAE 208 Engr. Dynamics	3
			18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BAE 402 Transport Phenomena	3	COM 110 Public Speaking	3
CE 382 Hydraulics or		ECE 211 Electrical Circuits I	3
MAE 308 Fluid Mechanics	3	ENG 331 Comm. for Engr. & Tech. or	
MAE 314 Solid Mechanics	3	ENG 333 Comm. of Sci. & Res. or	
Concentration Elective	3-4	BAE Elective	6
Engr. Science Elective	3	Free Elective	3
Physical Education I Elective	1	Laboratory Elective	1
	16 or 17	Physical Education Elective	1
			17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BAE 451 Engr. Design I	4	BAE 452 Engr. Design II	2
Engr. Science Elective	3	BAE Elective	3
Human./Social Sci. Elec.	6	Human./Social Sci. Elect.	6
Free Elective	3	Concentration Elective	3
Laboratory Elective	0-1	Free Elective	3
	16 or 17		17
		Minimum Hours Required for Graduation	135

BIOLOGICAL ENGINEERING CONCENTRATION

Requires CH 220, MAE 301, BAE 401, BAE 465, 6 hrs. from BAE elective list, and 9-10 hrs. from elective list of life science and engineering courses. For graduation, 135 semester hours are required.

ENVIRONMENTAL SOIL AND WATER ENGINEERING CONCENTRATION

Requires SSC 200, MAE 301, BAE 324, BAE 401, BAE 471, BAE 472, BAE 473, 6 hrs. from BAE elective list, and an advanced concentration elective. For graduation, 135 semester hours are required.

FOOD ENGINEERING CONCENTRATION

Requires CH 220, MAE 301, BAE 361, BAE 401, BAE 422, BAE 481, MB 401, FS 402, FS 421 and an advanced concentration elective. For graduation, 135 semester hours are required.

POWER AND MACHINERY ENGINEERING CONCENTRATION

Requires SSC 200, MAE 301, BAE 361, BAE 401, BAE 422, BAE 462, BAE 471, BAE 481 and 6 hrs. chosen from concentration list. For graduation, 135 semester hours are required.

List of BAE Elective Group Courses

BAE 361	Analytical Methods in Mechanical Design
BAE 422	Introduction to Food Process Engineering
BAE 465	Introduction to Biomedical Engineering
BAE 471	Land Resources Environmental Engineering
BAE 481	Structures and Environment

CHEMICAL ENGINEERING

Riddick Engineering Laboratories (Room 113)

Professor G. W. Roberts, Head of the Department

Professor C. J. Setzer, Associate Head of the Department and Coordinator of Advising

Professor C. K. Hall, Graduate Administrator

Distinguished University Professor: D. F. Ollis

Camille Dreyfus Professor: H. B. Hopfenberg

Hoechst Celanese Professors: R. G. Carbonell, R. M. Felder

Professors: K. G. Bachmann, R. G. Carbonell, P. S. Fedkiw, R. M. Felder, C. K. Hall, H. B. Hopfenberg, R. M. Kelly, D. C. Martin, D. F. Ollis, M. R. Overcash, G. W. Roberts, C. J. Setzer; Adjunct Professors: W. J. Koros, A. H. Wehe; Professors Emeriti: K. O. Beatty, J. K. Ferrell, D. B. Marsland, A. S. Michaels, V. T. Stannett; Associate Professors: C. M. Balik, S. A. Kahn, P. K. Kilpatrick, P. K. Lim, H. Winston; Adjunct Associate Professors: G. R. Husk, J. L. Williams; Assistant Professors: B. D. Freeman, C. S. Grant, H. H. Lamb, G. N. Parsons, S. W. Peretti.

The sound management of material, environmental, and energy resources, taking into account natural and economic constraints, guides the performance of chemical engineering practice. Chemical engineering education integrates design and analysis, science and technology, with communication skills developed through exposure to the humanities and the social and economic sciences. Chemical engineering organizes these diverse skills into a coherent discipline uniquely suited to the needs of the chemical, biochemical, environmental, petroleum, plastics, textile, and pulp and paper industries.

FACILITIES

Departmental teaching and research activities are based on the four floors comprising the east wing of the Riddick Engineering Laboratories. Equipment for studying the principles of fluid flow, heat transfer, distillation, absorption, drying, crystallization, and filtration is maintained in several laboratories. Chemical reaction kinetics including heterogeneous catalysis and polymerization are studied on specially designed equipment. Extensive apparatus is available for characterizing the relationships between molecular structure and bulk properties of polymers. A 2,000 square foot biotechnology laboratory has been equipped to include a pilot plant for studying biologically mediated chemical reactions. Specialized digital computational equipment complements campus wide University computer resources. The department makes constant use of its fully expanded

MicroVax 3600 computer system which is accessible for use 24 hours a day by students and faculty.

OPPORTUNITIES

Competition for chemical engineering graduates at all degree levels is intense. Graduates readily find employment at extremely attractive salaries in diverse subdisciplines including research and development, production, management and administration; process control, technical service, and sales; estimation and specification writing; consulting and teaching. Students desiring careers in teaching, research, or consulting are advised to consider graduate training (see listing of graduate degree offered). Chemical Engineering graduates often pursue careers in law or the medical sciences since the broadly structured undergraduate curriculum provides strong preparation for graduate study in a wide range of professional specialties.

CURRICULUM IN CHEMICAL ENGINEERING

The successful practice of chemical engineering requires a broad, diversified preparation. The spirit of research and experimental inquiry is vital; students, therefore, require sound scientific backgrounds essential to original and disciplined thought, enthusiastic inquiry and, ultimately, original and constructive accomplishment. The undergraduate curriculum emphasizes the scientific, engineering, and economic principles involved in the design and operation of chemical processes. The background in organic, physical, and inorganic chemistry is comparable to the training offered to chemistry majors. Mathematics, physical sciences, and distributed humanities courses are also required. The Chemical Engineering program, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), leads to the degree Bachelor of Science in Chemical Engineering.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Chem. Principles & Appl.	3
CH 121 General Chemistry I Lab	1	CH 127 Chem. Prin. & Appl. Lab	1
E 100 Introduction to COE	0	ENG 112 Composition & Reading	3
E 115 Intro. to Computing Envr.	1	MA 241 Analyt. Geom. & Calculus II	4
ENG 111 Composition & Rhetoric	3	PY 205 Physics for Engrs. & Sci. I	4
MA 141 Analyt. Geom. & Calculus I	4	Physical Education Elective	1
Human. Social Sci. Elec.	3		16
PE 100 Health and Physical Fitness	1		
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 221 Organic Chemistry I	4	CH 223 Organic Chemistry II	4
CHE 205 Chemical Pro. Prin.	4	CHE 225 Chemical Proc. Systems	3
CSC 112 Intro. to Comp FORTRAN	3	MA 341 Appl. Diff. Eqn.	3
MA 242 Analyt. Geom. & Calculus III	4	PY 208 Physics for Engrs. & Sci. II	4
Physical Education Elective	1	Human. Social Sci. Elec.	3
	16	Physical Education Elective	1
			18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CHE 311 Transport Processes I	3	CH 437 Physical Chemistry	4
CHE 315 Chem. Pro. Thermo.	3	CHE 312 Transport Processes II	3
ECE 331 Princ. Elect. Engr	3	CHE 316 Therm. Chem. & Phase Equil.	3
MAT 201 Struc. & Prop. of Engr. Mat.	3	CHE 330 Chemical Engr. Lab I	2
Human. Social Sci. Elec.	3	Human. Social Sci. Elec.	3
Free Elective	3		15
	18		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CHE 331 Chemical Engr. Lab II	2	CH 315 Quantitative Analysis	4
CHE 446 Des. & Analy. Chem. React.	3	CHE 425 Proc. Syst. Analy. & Control	3
CHE 450 CHE Design I	3	CHE 451 CHE Design II	3
CHE 495 Seminar in Chem. Engr.	1	Human, Social Sci. Elec.	3
Human, Social Sci. Elec.	3	Free Elective	3
Free Elective	3		16
15		Minimum Hours Required for Graduation	130

BIOSCIENCES OPTION IN CHEMICAL ENGINEERING

By enhanced exposure to the biological sciences, the Biosciences option in Chemical Engineering enables the student to develop insight into biological systems and processes.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Chem. Principles & Appl.	3
CH 121 General Chemistry I Lab	1	CH 127 Chem. Princ. & Appl. Lab	1
E 100 Introduction to COE	0	ENG 112 Composition & Reading	3
E 115 Intro. to Computing Envr.	1	MA 241 Analyt. Geom. & Calculus II	4
ENG 111 Composition & Rhetoric	3	PY 205 Physics for Engrs. & Sci. I	4
MA 141 Analyt. Geom. & Calculus I	4	Physical Education Elective	1
Human, Social Sci. Elec.	3		16
PE 100 Health and Physical Fitness	1		
16			

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 221 Organic Chemistry I	4	CH 223 Organic Chemistry II	4
CHE 205 Chemical Pro. Prin.	4	CHE 225 Chemical Proc. Systems	3
CSC 112 Intro. to Comp. FORTRAN	3	MA 341 Appl. Diff. Eqn.	3
MA 242 Analyt. Geom. & Calculus III	4	PY 208 Physics for Engrs. & Sci. II	4
Human, Social Sci. Elec.	3	Human, Social Sci. Elec.	3
18		Physical Education Elective	1
		18	

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 General Biology	4	BCH 451 Elementary Biochemistry	3
CHE 311 Transport Processes I	3	BCH 452 Elementary Biochem. Lab I	2
CHE 315 Chem. Pro. Thermo.	3	CHE 312 Transport Processes II	3
ECE 331 Prin. Elec. Engr. or	3	CHE 316 Therm. Chem. & Phase Equil.	3
MAT 201 Struc. & Prop. of Engr. Mat.	3	CHE 330 Chemical Engr. Lab I	2
Free Elective	3	Human, Social Sci. Elec.	3
Physical Education Elective	1		16
17			

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 437 Physical Chemistry	4	CHE 425 Proc. Syst. Analy. & Control	3
CHE 331 Chemical Engr. Lab II	2	CHE 451 CHE Design II	3
CHE 446 Des. & Analy. Chem. React.	3	CHE 551 Biochemical Engineering	3
CHE 450 CHE Design I	3	Human, Social Sci. Elec.	3
CHE 495 Seminar in Chem. Engr.	1	Free Elective	3
Human/Social Sci. Elec.	3	Free Elective	3
16		18	
		Minimum Hours Required for Graduation	135

CIVIL ENGINEERING

Mann Hall (Room 203)

Professor E. Downey Brill, Jr., Head of the Department

Professor H. E. Wahls, Associate Head for Graduate Programs

Professor J. S. Fisher, Associate Head

Professor J. F. Ely, Coordinator of Advising

Distinguished University Professor: P. Z. Zia

Civil Engineering Distinguished Professor: J. M. Hanson

Harrison Professor: P. H. McDonald

Professors: S. H. Ahmad, E. D. Brill, R. A. Douglas, J. F. Ely, J. S. Fisher, W. S. Galler, C. G. Gilbert, A. K. Gupta, J. M. Hanson, K. S. Havner, Y. Horie, D. W. Johnston, N. P. Khosla, P. H. McDonald, C. C. Tung, H. E. Wahls, P. Z. Zia; Adjunct Professor: R. C. Heath; Professors Emeriti: M. Amern, P. D. Cribbins, R. E. Fadum, C. L. Heimback, J. W. Horn, A. I. Kachef, C. L. Mason, Jr., S. W. Nunnally, C. Smallwood, Jr., M. E. Uyanik; Associate Professors: L. E. Bernold, W. L. Bingham, R. C. Borden, R. H. Borden, A. C. Chao, E. D. Gurley, P. C. Lambe, H. R. Malcom, V. C. Matzen, J. M. Nau, M. F. Overton, M. S. Rahman, W. J. Rasdorf, J. C. Smith, J. R. Stone; Associate Professor Emeritus: G. R. Taylor; Assistant Professors: M. A. Barlaz, J. W. Baugh, Jr., F. Farid, J. E. Hummer, Y. R. Kim, S. E. Liehr, A. E. Schultz; Adjunct Assistant Professors: J. C. Brantley, III, L. R. Goode, B. E. Matthews; Lecturers: M. L. Leming, D. J. Lombardi; Lecturer and Senior Construction Extension Specialist: P. P. McCain; Adjunct Lecturers: R. F. DeBruhl, B. A. Doll; Interim/Temporary Adjunct Faculty: R. A. Luettich, Jr.; Senior Extension Specialist: S. M. Rogers, Jr.

Civil Engineering is one of the broader engineering fields. It is concerned with the improvement and control of the environment and deals with the planning, design, construction, operation, and maintenance of buildings, dams, bridges, harbors, power facilities, pollution control facilities, water supply, and transportation systems. The Department of Civil Engineering offers curricula that provide academic preparation for students considering a career in civil, construction, or environmental engineering. The sound general education of the undergraduate program prepares the student for advanced study, either through graduate study or self study.

The Civil Engineering program, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), leads to the degree Bachelor of Science in Civil Engineering. The Civil Engineering-Construction option program, also accredited by ABET, leads to the degree of Bachelor of Science in Civil Engineering-Construction option. The new Environmental Engineering program will be presented for accreditation to ABET following graduation of the first class. The Construction Management program leads to the degree of Bachelor of Science in Construction Management.

OPPORTUNITIES

People will always need constructed facilities to live, work, and sustain their lives and environment, and civil, construction, and environmental engineers will always be needed to plan, design, and construct these facilities. Civil, construction, and environmental engineering comprises such a diversified field that graduates have a wide choice in locations and types of employment. Jobs range from federal, state or municipal agencies to a variety of manufacturing and processing industries, consulting firms or construction companies. The work may be performed partially or wholly in an office or in the field and may be located in a small community, a large industry center or in a foreign country. Careers in teaching and research are common for many graduates who complete advanced degrees.

FACILITIES

Open access is available to a state-of-the-art computer laboratory providing support in analysis, design-synthesis, and word processing. Laboratories for testing structural materials, large models or full-scale structures; for the investigation of soils and bituminous

products; for hydraulic experiments; for analysis of small structural models; for chemical and biological tests pertaining to environmental engineering; for construction process modeling, management, and automation; and for the investigation of transportation problems all help students learn more about their field.

CURRICULA

Four undergraduate curricula are offered; one leads to a Bachelor of Science in Civil Engineering; the second, to a Bachelor of Science in Civil Engineering-Construction option; the third, to a Bachelor of Science in Environmental Engineering; and the fourth, to a Bachelor of Science in Construction Management.

The Civil Engineering curriculum is a balanced program providing academic discipline in mathematics, the physical sciences, the humanities and social sciences, and the technical aspects of civil engineering. After introductory exposure to several of the professional areas such as environmental and water resources, geotechnical, structural, and transportation engineering, the student builds additional depth in one of these specialties.

The curriculum in the Civil Engineering-Construction option is designed for students interested in the construction phases of civil engineering. It includes the core course requirements in mathematics, the physical sciences, and the humanities and social sciences. After an introductory exposure to the fundamentals of civil engineering, the curriculum provides a series of specialty courses in construction engineering related to the analysis, design, and management of the construction process.

The curriculum in Environmental Engineering is designed for students interested in working in the areas of waste treatment, pollution control, and environmental restoration after graduation. The curriculum includes introductory civil engineering courses in mechanics as well as courses in chemical engineering, the life sciences, and specialized courses focusing on environmental engineering.

The Bachelor of Science in Construction Management is offered for students interested in entering the construction industry with somewhat more management background. Graduates of this curriculum are exposed to broader construction management problems involving business and finance along with the basics of engineering training. This curriculum features an off-campus internship program during two summers with a construction firm. The student selects a construction concentration in either general construction, mechanical construction or electrical construction.

POST-BACCALAUREATE STUDY

If a student is interested in more intense specialization in a particular area, advanced level training is available leading to the Professional Degree in Civil Engineering, the Master of Civil Engineering, the Master of Science or the Doctor of Philosophy. Specialization areas include coastal and ocean engineering, construction engineering and management, construction materials, environmental and water resources engineering, geotechnical engineering, mechanics and structural engineering and transportation engineering. With judicious choice of electives, a student may also prepare for additional study in law, business administration, business management and city and regional planning. The College of Management offers a Master of Science in Management with several technical options including Civil Engineering Construction.

CIVIL ENGINEERING CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 110 Intro. to Comp. PASCAL	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Ana. yt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci I	4
ENG 111 Composition & Rhetoric	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		
PF 100 Health and Physical Fitness	1		15
Human. Social Sci Elec	3		

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 214 Engr. Mechanics Statics ¹	3	CE 215 Engr. Mech. Dynamics	3
GC 101 Engineering Graphics	2	CE 313 Mechanics of Solids	3
MA 242 Analyt. Geom. & Calculus III	4	MA 341 Applied Diff. Eqn. I	3
PY 208 Physics for Engrs. & Sci. II	4	MAT 200 Mech. Prop. of Struc. Mat.	3
Physical Education Elective	1	Human./Social Sci. Elec. ¹	3
	14	Physical Education Elective	1
		<hr/>	16

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 324 Struct. Behavior Meas.	1	CE 305 Traffic Engineering	3
CE 325 Structural Analysis	3	CE 327 Reinforced Concrete Des.	3
CE 332 Materials of Construction	3	CE 342 Engr. Behav. of Soils & Foun.	4
CE 375 Civil Engr. Systems	3	CE 383 Hydro. & Urban Wat. Sys. or	
CE 381 Hydraulics Lab	1	CE 384 Intro. Environ. Engr.	3
CE 382 Hydraulics	3	Basic Science Elective ¹	4
Human./Social Sci. Elec. ¹	3		17
	17	<hr/>	17

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE Design Elec. I ⁴	3	CE Design Elec. II ⁴	3
COM 110 Public Speaking or		Human./Social Sci. Elec. ¹	3
ECE 331 Prin. of Elec. Engr. or		Human./Social Sci. Elec. ¹	3
ENG 331 Communic. Engr. & Tech.	3	Free Elective	3
MAE 301 Engr. Thermodynamics I	3	Free Elective	3
Engr. Science Elec. ²	3		15
Human./Social Sci. Elec. ¹	3		<hr/>
Free Elective	3	Minimum Hours Required for Graduation	128
	18		<hr/>

¹To be taken according to the requirements of the College of Engineering.

²Must be passed with a grade of C or higher.

³Select one from BS 100 General Biology (4); CH 107 Principles of Chemistry (3) and Principles of Chemistry Lab (1); or

MEA 101 Geology I: Physical (3) and MEA 110 Geology Laboratory (1)

⁴Contact department Coordinator of Advising for a list of approved courses

CIVIL ENGINEERING—CONSTRUCTION OPTION

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 110 Intro. to Comp./PASCAL	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	4
ENG 111 Composition & Rhetoric	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		15
PE 100 Health and Physical Fitness	1		<hr/>
Human./Social Sci. Elec. ¹	3		16
	16		<hr/>

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 200 Civil Engr. Meas. & Survey	3	CE 215 Engr. Mech. Dynamics	3
CE 214 Engr. Mechanics Statics ²	3	CE 313 Mechanics of Solids	3
GC 101 Engineering Graphics	2	MA 341 Applied Diff. Eqn. I	3
MA 242 Analyt. Geom. & Calculus III	4	MAT 200 Mech. Prop. of Struc. Mat.	3
PY 208 Physics for Engrs. & Sci. II	4	Human./Social Sci. Elec. ¹	3
Physical Education Elective	1	Physical Education Elective	1
	17	<hr/>	16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 325 Structural Analysis	3	CE 305 Traffic Engineering or	
CE 332 Materials of Construction	3	CE 367 Mech. & Elec. Sys. in Bldg. or	
CE 375 Civil Engr. Systems	3	CE 383 Hydro. & Urban Wat. Sys.	3
CE 382 Hydraulics	3	CE 327 Reinforced Concrete Des.	3
CE 463 Const. Est., Plan & Contr.	3	CE 342 Engr. Behav. of Soils & Foun.	4
Human./Social Sci. Elec. ¹	3	CE 465 Construct. Equip. & Methods	3
	18	Basic Science ²	4
			17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 426 Steel Design	3	ACC 280 Managerial Acct. or	
CE 464 Legal Aspects of Contracting	3	BUS 330 Human Resource Mgmt.	3
CE 466 Bldg. Constr. Engr.	3	CE 469 Const. Engr. Project	3
ECE 331 Prin. Elect. Engr. or		Human./Social Sci. Elec. ¹	3
MAE 301 Engr. Thermodynamics	3	Human./Social Sci. Elec. ¹	3
Human./Social Sci. Elec. ¹	3	Free Elective	3
Free Elective	3	Free Elective	3
	18		18

Minimum Hours Required for Graduation 135

¹To be taken according to the requirements of the College of Engineering.

²Must be passed with a grade of C or higher.

³Select One from BS 100 General Biology (4); CH 107 Principles of Chemistry (3) and Principles of Chemistry Lab (1); or MEA 101 Geology I: Physical (3) and MEA 110 Geology Laboratory (1)

ENVIRONMENTAL ENGINEERING

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Principles of Chemistry	3
CH 121 General Chemistry I Lab	1	CH 127 Principles of Chemistry Lab	1
E 100 Introduction to COE	0	ENG 112 Composition & Reading	3
E 115 Intro. to Computing Envir.	1	MA 241 Analyt. Geom. & Calculus II	4
ENG 111 Composition & Rhetoric	3	PY 205 Physics for Engrs. & Sci. I	4
MA 141 Analyt. Geom. & Calculus I	4	Physical Education Elective	1
PE 100 Health & Physical Fitness	1		
Humanities/Social Sci. Elec. ¹	3		16
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 214 Engr. Mech. Statics ²	3	CE 215 Engr. Mech. Dynamics	3
CHE 205 Chemical Proc. Principles ²	4	CE 280 Princ. of Envir Engr	3
CSC 112 Intro. to Comp. (FORTRAN)	3	COM 110 Public Speaking or	
MA 242 Analyt. Geom. & Calculus III	4	ENG 331 Communic. Engr. & Tech.	3
Humanities/Soc. Sci. Elective ³	3	MA 341 App. Diff. Equations I	3
	17	Basic Science Elective ³	4
			16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 313 Mechanics of Solids	3	CE 342 Engineering Behavior of Soils	4
CE 381 Hydraulics Sys. Meas. Lab.	1	CE 375 Civil Engineering Systems	3
CE 382 Hydraulics	3	Basic Science Elective ³	4
ST 361 Intro. Statistics for Engr.	3	Humanities/Soc. Sci. Elective ¹	3
Engr. Science Elec. ³	3	Physical Education Elective	1
Humanities/Soc. Sci. Elective ¹	3		
	16		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 383 Hydrology & Urban Water Sys.	3	CE 485 Solid Waste Engr.	3
CE 456 Air Quality Engineering	3	Engineering Science Elective ¹	3
CE 480 Water Resources Engr. Project	3	Humanities/Soc. Sci. Elective ¹	3
CE 484 Water Supp. & Waste Watr Sys.	3	Humanities/Soc. Sci. Elective ¹	3
Free Elective	3	Free Elective	3
Physical Education Elective	1		15
	16	Minimum Hours Required for Graduation	127

¹To be taken according to the requirements of the College of Engineering

²Must be passed with a grade of C or higher.

³Contact department Coordinator of Advising for a list of approved courses

CONSTRUCTION MANAGEMENT

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 110 Intro. to Comp./PASCAL	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	4
EC 201 Economics I	3	Physical Education Elective	1
ENG 111 Composition & Rhetoric	3		15
MA 141 Analyt. Geom. & Calculus I	1		
PE 100 Health and Physical Fitness	1		
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 200 Civil Engr. Meas. & Survey	3	CE 215 Engr. Mechanics Dynamics	3
CE 214 Engr. Mechanics Statics ²	3	CE 313 Mechanics of Solids	3
GC 101 Engineering Graphics	2	EC 301 Intermed. Microeconomics	3
MA 242 Analyt. Geom. & Calculus III	4	MA 341 Appl. Differ. Eqn. I	3
PY 208 Physics for Engrs. & Sci. II	4	MAT 200 Mech. Prop. of Struct. Matl.	3
Physical Education Elective	1	Physical Education Elective	1
	17		16

SUMMER INTERNSHIP OFF CAMPUS

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 280 Managerial Acct.	3	CE 367 Mech. & Elec. Sys. in Bldg.	3
CE 332 Materials of Constr.	3	COM 146 Business & Prof. Commun.	3
CE 463 Constr. Est., Plan., & Contr.	3	EC 302 Intermed. Macroeconomics	3
Constr. Concen. Elective ³	3	EC 320 Financial Mgmt.	3
Constr. Concen. Lab Elec. ³	1	Constr. Concen. Elective ³	3
Constr. Concen. Elective ³	3	Constr. Concen. Elective ³	3
	16		18

SUMMER INTERNSHIP OFF CAMPUS

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 464 Legal Aspects of Contracting	3	CE 469 Const. Engr. Proj.	3
BUS 310 Managerial Economics	3	Adv. Human. Elec. ⁴	3
BUS 330 Human Resources Mgmt.	3	Constr. Concen. Elective ³	3
BUS 380 Marketing Methods or	3	Hist./Phil. of Sci. Elec. ⁴	3
Constr. Concen. Elective ³	3	Free Elective	3
Intro. Human. Elec. ⁴	3	Free Elective	3
Free Elective	3		18
	18	Minimum Hours Required for Graduation	134

¹To be taken according to the requirements of the College of Engineering

²Must be passed with a grade of C or higher.

³Contact department Coordinator of Advising for a list of approved courses

COMPUTER SCIENCE

Withers Hall (Rooms 226 and 208)

Professor A. L. Tharp, Interim Head of the Department

Lecturer J. Hatch, Assistant Head of the Department, Coordinator of Advising

Professor D. C. Martin, Director of Freshman Program

Lecturer W. G. Scott, Jr., Interim Assistant Head for Administration

Distinguished University Research Professor: D. L. Bitzer

Alumni Distinguished Undergraduate Professor: A. L. Tharp

Professors: W. Chou, R. J. Fornaro, R. E. Funderlic, D. C. Martin, D. F. McAllister, H. G. Perros, W. J. Stewart, K. C. Tai, A. L. Tharp; Associate Professors: J. A. Bowen, E. W. Davis, Jr., E. F. Gehringer, T. L. Honeycutt, H. D. Levin, W. E. Robbins, R. D. Rodman, C. D. Savage, M. F. Stallman, M. A. Vouk; Assistant Professors: D. R. Bahler, W. R. Cleveland II, R. A. Dwyer, A. Ola, D. S. Reeves; Adjunct Assistant Professors: K. D. Clark; Lecturers: J. Hatch, T. E. Nelson, J. E. Perry, W. G. Scott, Jr.; Visiting Instructors: C. S. Miller, B. A. Pescoek, D. C. Strickland; Adjunct Lecturers: E. W. Galloway, D. A. Lasher, J. E. Pierce, D. A. Schur, D. G. Taylor, S. G. Warth, III; Research Assistant: L. W. Taylor; Associate Members of the Department: J. W. Baugh, Jr. (Civil Engineering), C. D. Meyer, Jr. (Mathematics), T. K. Miller III (Electrical and Computer Engineering), I. Viniotis (Electrical and Computer Engineering).

The discipline of computer science has emerged during the past three decades as a result of the rapid growth of the use of computers. This unprecedented technical revolution has made computers a part of normal life. Almost all areas of business and industry, the military, government, and education use computers. New applications continue to occur. Computers are used to design, manufacture and operate our automobiles, airplanes and spaceships, to design our highways, bridges and buildings, to manage banking transactions, to help managers decide, to analyze farm production, to assist the research scientist; to monitor manufacturing processes, utilities and communication

OPPORTUNITIES

Computer scientists have a wide range of career choices because of the diversity of computer use. A graduate may be involved in the design, implementation, or management of computer systems. Some may work more with advancing computer capabilities while others may apply computers to new applications. Others may go on for advanced study. Some may wish to interact frequently with people, some may not. Computer science offers opportunities for all ambitions and preferences.

CURRICULUM IN COMPUTER SCIENCE

This undergraduate curriculum leads to the degree of Bachelor of Science in Computer Science. This program is accredited by the Computer Science Accreditation Commission of the Computing Sciences Accreditation Board. Core courses provide the fundamentals of programming concepts, operating systems, data structures, computer architecture, and the theory of computation. Restricted electives chosen in consultation with one's advisor during the junior year allow exploration of specific computer science subareas such as management information systems, database management systems, graphics, operating systems, and software engineering. A student in another department may select courses in computer science as electives to broaden his/her program of study and to learn how to use the computer for solving problems. Before a computer science major is eligible to enroll in any 200 or 300 level required course in computer science, the student must have a 2.4 or higher grade point average.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I ¹	4	CSC 110 Intro. to Comp.—Pascal	3
E 100 Intro. to COE	0	ENG 112 Composition & Reading ¹	3
E 115 Intro. to Computing Environments	1	MA 241 Analytic Geom. & Calculus III	4
ENG 111 Composition & Rhetoric ¹	3	PY 205 Physics for Engrs. & Sci. I ¹	4
MA 141 Analytic Geom. & Calculus I ¹	4	Physical Education Elective	1
PE 100 Health & Physical Fitness	1		
Human./Social Science Elective ²	3		
	<hr/>		<hr/>
	16		15

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 210 Programming Language Concepts	3	CSC 201 Comp. Org. & Assem. Lang.	3
CSC 222 Applied Discrete Mathematics	3	CSC 311 Data Structures	3
EC 201 Economics I	3	MA 305 Intro. to Linear Algebra	3
MA 242 Analytic Geom. & Calculus III	4	Basic Science Elective ²	3
PY 208 Physics for Engrs. & Sci. II	4	Human./Social Science Elective	3
Physical Education Elective	1	Physical Education Elective	1
	<hr/>		<hr/>
	18		16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 202 Operating Systems	3	CSC 302 Intro. to Numerical Methods	3
CSC 312 Comp. Organization & Logic	4	CSC 379 Ethical Implications of Comp.	1
CSC 333 Automata Theory	3	ENG 331 Comm. for Eng. & Technology	3
CSC Restricted Elective ³	3	ST 371 Intro. to Probability	3
Human./Social Science Elective	3	CSC Restricted Elective ³	3
	<hr/>	Free Elective	3
	16		<hr/>
			16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 310 Software Engineering	3	CSC Restricted Elective ³	3
CSC Project Course ⁴	3	Human./Social Science Elective	3
Human./Social Science Elective	3	Restricted Elective	3
Restricted Elective	3	Restricted Elective	3
Free Elective	3	Free Elective	3
	<hr/>		<hr/>
	15		15

Minimum Hours Required for Graduation 127

¹D grades are not accepted in CH 101, CSC 110, ENG 111, ENG 112, MA 141, MA 241, and PY 205.

²To be selected from CH 107, PY 223, PY 240, or any BO, BS, MEA, PM, PP, ZO.

³Any CSC 300-level or higher except for 421, 422, 423, 427, or 428.

⁴To be selected from CSC 432, 452, 462, or 472.

MINOR IN COMPUTER PROGRAMMING

The Department of Computer Science offers a minor in Computer Programming to undergraduate majors in any field except computer science and computer engineering. Undergraduates will be admitted to the minor only if they have an overall GPA of at least 2.25. The minor consists of the completion with a grade of C or higher of E 115 (S/U grading), CSC 110, 201, 202, 210, 222, 311, a second programming language (FORTRAN or C), and MA 121 (or any college calculus course). At least five of these nine courses must be taken at NCSU.

ELECTRICAL AND COMPUTER ENGINEERING

Daniels Hall (Room 232)

Professor R. K. Cavin III, Head of the Department

Visiting Associate Professor J. J. Brickley, Jr., Associate Head of the Department

Visiting Assistant Professor G. E. Edgington, Graduate Coordinator

Lecturer J. H. Larson, Coordinator of Advising

University Professor: D. R. Rhodes

Alumni Distinguished Undergraduate Professor: M. A. Littlejohn

Alumni Distinguished Graduate Professor: J. B. O'Neal, Jr.

*Professors: D. P. Agrawal, W. E. Alexander, B. J. Baliga, S. M. Bedair, W. Chou, T. H. Glisson, J. J. Grainger, J. R. Hauser, J. F. Kauffman, R. M. Kolbas, M. A. Littlejohn, R. C. Luo, N. A. Masnari, N. F. J. Matthews, L. K. Monteith, H. T. Nagle, Jr., A. A. Nilsson, J. B. O'Neal, Jr., C. M. Osburn, S. A. Rajala, A. Reisman, D. R. Rhodes, W. E. Snyder, R. J. Trew, H. J. Trussell, A. Vander Lugt, J. J. Wortman; *Adjunct Professors: E. Brglez, R. C. Eberhart, J. W. Gault, W. C. Holton, G. J. Iafrate, M. A. Strocio, R. Tsu, R. L. Witcofski; Professors Emeritus: W. J. Barclay, A. R. Eckles, A. J. Goetze, G. B. Hoadley, F. J. Tischer; Associate Professors: S. T. Alexander, W. T. Easter, E. F. Gehringer, R. S. Gyurcsik, W. T. Liu, T. K. Miller, III, J. J. Paulos, M. B. Steer, M. W. White; *Adjunct Associate Professors: J. R. Burke, J. A. Hutchby, S. H. Lee, H. L. Martin, J. W. Mink; Associate Professors Emeritus: N. R. Bell, E. G. Manning, W. C. Peterson; Assistant Professors: M. Y. Chow, P. D. Franzon, A. W. Kelly, K. W. Kim, P. K. McLarty, M. C. Ozturk, D. S. Reeves, J. K. Townsend, D. E. Van den Bout, I. Viniotis; Visiting Assistant Professor: M. Baran; *Adjunct Assistant Professors: D. L. Drefus, D. W. Hislop, T. H. Hubing, P. Santiago, C. K. Williams; Assistant Professor Emeritus: L. R. Herman; Lecturers: R. T. Kuehn, J. H. Shelly; *Adjunct Lecturers: C. E. Branscomb; Research Associates: G. L. Bilbro, R. Hamaker, J. Ramdani, H. Tian, X. Xu; Research Assistants: E. S. Condon, J. M. O'Sullivan; Associate Members of the Departments of: D. Bitzer (Computer Science), E. Davis, (Computer Science), G. Lucovsky (Physics), J. Narayan (Materials Science and Engineering), H. Perros (Computer Science), W. Robbins (Computer Science), J. F. Schetzina (Physics), M. Stallman (Computer Science), M. Vouk (Computer Science).*****

The professions of electrical engineering and computer engineering are concerned with the analysis, design, construction and testing of systems based on electrical phenomena. In contemporary technological society, electrical methods are used to communicate and store information, control equipment and systems, perform mathematical operations, and convert energy from one form to another. Frequently, two or more of these functions are important in the design of systems such as television, radio, telecommunications, computers, robots and intelligent machines, telemetry systems, solid state electronics, biomedical devices, electric machinery, and electric power generation and transmission facilities. Computer engineering is a field in which digital techniques are used in system design. Low-cost solid state microprocessors and memories permit computers to be widely incorporated in many different types of electronic systems. To work effectively in this rapidly growing field, the computer engineer must understand both hardware and software techniques and must effectively use both techniques in order to design, build and test complex digital systems. Both the electrical engineering and the computer engineering programs, which lead respectively to the degrees, Bachelor of Science in Electrical Engineering and Bachelor of Science in Computer Engineering, are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

SCHOLARSHIPS AND AWARDS

Superior academic performance is recognized within this department in three ways: election of students to membership in the electrical engineering honor society, Eta Kappa Nu; awarding of merit scholarships; and presentation of awards to outstanding seniors. The department has one endowed merit scholarship for entering freshmen, the Eugene C. and Winifred Sakshaug Scholarship, and eight endowed scholarships which are usually awarded to juniors and seniors: Elizabeth P. Cockrell, L. A. Mahler, Amelia N. Mitta, Frank T. Pankotay, William DeRosset Scott III, E. Chester Seewald, North Carolina

Electric Membership Corporation, and William D. Stevenson, Jr., the latter two of which are for students studying electric power systems. The department also from time to time has scholarships provided by industrial organizations such as the Alcoa Foundation, General Motors Corporation and United Technologies Research Center. Academic merit is generally the primary requirement for these awards, but other characteristics, such as demonstrated leadership, may also be specified. In addition, the endowed William M. Cates Scholarship Program provides multiple scholarships for students having documented financial need and high academic performance. These are awarded each fall to juniors, with provision for continuation in the senior year.

FACILITIES

Many courses are accompanied by coordinated laboratory work and projects. These assignments typically focus on real world systems and problems and involve computer simulation and analysis, design, development and testing of hardware and software associated with electrical, electronic, and electromechanical systems, circuits and devices. Extensive facilities are provided for experimental study of analog and digital circuits, microprocessors, computers, electrical machinery, VLSI devices, robots and intelligent machines, telecommunications, and microwave systems. The EOS System, a network of state of the art engineering workstations, provides a powerful computing environment available to all students. Two EOS laboratories with more than sixty workstations, mostly color, are located within the department. Electrical and Computer Engineering provides knowledgeable attendants in these laboratories up to eighteen hours a day. A student may log in at over 500 workstations located in these two laboratories and several other facilities throughout the College of Engineering. Powerful software is provided on the system for engineering analysis, design and testing, symbolic mathematics, sophisticated color graphics, scientific spreadsheets, programming languages, word processing, document formatting and other special applications. The department has an Undergraduate Design Center which provides resources for required industry sponsored, semester-long design projects. Weekly sessions are scheduled in the Undergraduate Teaching Center by teaching assistants to answer student questions about course material. Both centers are equipped with EOS workstations.

CORE COURSES

The Electrical and Computer Engineering curricula share core courses comprising a substantial portion of the first three years of study. Strong emphasis is placed on fundamental concepts in core courses so that graduates are prepared for rapid technological changes common in the electrical and computer engineering professions. A comprehensive foundation in mathematics and the physical sciences in the freshman year is followed in subsequent years by additional core courses in mathematics, physics, electric circuit theory, digital logic, computer systems, electronics, linear systems, and mechanics. Laboratory work is designed to demonstrate fundamental principles and to provide experience in designing and testing electronic hardware and computer software. Both curricula have required senior design courses which give students comprehensive experience in designing, building and testing physical systems.

ELECTRICAL ENGINEERING CURRICULUM

In addition to the core courses described above, students in the Electrical Engineering curriculum take courses in electromagnetic fields, solid-state devices, and electric power systems in their junior year and thermodynamics in their senior year. Students may take two courses of their choice in the senior year from more than 20 elective courses offered in communications, control systems, digital systems, electric power systems, electromagnetics, microelectronics, and robotics.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 110 Intro. to Comp. PASCAL	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	4
ENG 111 Composition & Rhetoric	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		15
Human./Social Sci. Elec.	3		
PE 100 Health and Physical Fitness	1		
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
COM 110 Public Speaking	3	CE 213 Intro. to Mechanics	3
ECE 211 Electric Circuits I	3	ECE 212 Fund. of Logic Design	3
ECE 213 Electric Circuits I Lab	1	ECE 214 Fund. Logic Design Lab	1
MA 242 Analyt. Geom. & Calculus III	4	ECE 221 Electric Circuits II	3
PY 208 Physics for Engrs. & Sci. II	4	ECE 223 Electric Circuits II Lab	1
Physical Education Elective	1	MA 341 Differential Eqns.	3
	16	Physical Education Elective	1
			15

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ECE 301 Linear Systems	3	ECE 218 Comp. Org. & Microproc.	3
ECE 303 Electromagnetic Fields	3	ECE 305 Electric Power Systems	3
ECE 314 Electronic Circuits	3	ECE 341 Solid State Devices	3
MA 314 Probability, Appl. to ECE	3	ENG 331 Commun. Tech. & Engr.	3
Human. Social Sci. Elec.	3	Human. Social Sci. Elec.	3
	15		15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
COM 301 Presentational Speaking	3	ECE 480 Senior Design Proj.	4
MAE 301 Engr. Thermodynamics	3	Human. Social Sci. Elec.	3
Approved Dept. Elective or		Human. Social Sci. Elec.	3
Senior Design Elective	3	Senior Design Elective	3
Human. Social Sci. Elec.	3		13
Numerical Methods Elec.	3		
	15	Minimum Hours Required for Graduation	120

COMPUTER ENGINEERING CURRICULUM

In addition to the core courses described above, students in the Computer Engineering curriculum take courses in discrete mathematics, design of complex digital systems, advanced programming, operating systems, and data structures in their sophomore and junior years. Students may take three courses of their choice in the senior year. A variety of elective courses are offered in communications, controls, digital systems, microelectronics, and VLSI design. In addition, several senior-level courses in computer science are approved as elective courses for computer engineering. (A revised Computer Engineering curriculum with 120 credit hours required for graduation, paralleling the Electrical Engineering curriculum above, is under consideration to be effective in 1993).

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry ¹	4	CSC 110 Intro. to Computing	3
E 100 Intro. to College of Engr.	0	ENG 112 Composition & Reading	3
E 115 Intro. to Computing Environ.	1	MA 241 Analyt. Geom. & Calc. II ¹	4
ENG 111 Composition & Rhetoric ¹	3	PY 205 Physics Engrs. & Scien. I ¹	4
MA 141 Analy. Geom. & Calc. I ¹	4	Physical Education Elective	1
PE 100 Health & Phys. Fitness	1		15
Humanities Social Science Elective	3		
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 210 Concepts of Programming Languages ...	3	CSC 222 Discrete Math. Structures	3
ECE 212 Fund. of Logic Design ¹	3	ECE 211 Electric Circuits I ¹	3
ECE 214 Fund. of Logic Design. Lab.	1	ECE 213 Electric Circuits I Lab	1
MA 242 Analy. Geom. & Calc. III	4	ECE 218 Comp. Org. & Microproc. ¹	3
PY 208 Physics Engrs. & Scien. II	4	MA 341 Differential Equations	3
Physical Education Elective	1	Physical Education Elective	1
	16		14

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 202 Concepts Facil. Op. Syst.	2	CSC 311 Data Structures ²	3
ECE 221 Electric Circuits II ¹	3	ECE 301 Linear Systems	3
ECE 223 Electric Circuits II Lab.	1	ECE 314 Electronic Circuits	3
ECE 342 Dagn. Complex Digital Syst.	3	ENG 331 Communic. Engr. & Tech.	3
MA 314 Probability, Applic. to ECE	3	Humanities/Social Science Elective ²	3
Communication Elective ²	3		15
	15		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 213 Intro. to Mechanics	3	ECE 481 CPE Senior Design Project	4
CPE Senior Elective ³	3	Senior Design Elective ³	3
Numerical Methods Elective ⁴	3	Humanities/Social Science Elective ²	3
Humanities/Social Science Elective ²	3	Humanities/Social Science Elective ²	3
Humanities/Social Science Elective ²	3	Free Elective	3
	15		16
		Minimum Hours Required for Graduation	122 ⁴

¹Must be completed with a grade of C or higher.

²To be taken according to the requirements of the College of Engineering.

³Contact coordinator of advising for list of approved courses.

⁴The GPA earned on all courses attempted at NCSU must be 2.0 or higher to satisfy University graduation requirements. In addition, the College requires either (1) a GPA of 2.0 or higher on all courses bearing the ECE designation or (2) a grade of C or higher in each ECE course used to satisfy requirements in the major. CSC courses used for CPE Senior Electives must satisfy the same grade requirements as ECE courses in (1) and (2) above. Graduation requirements also include attendance at two professional technical society meetings during the junior and senior years. The student is responsible for providing documentation showing satisfaction of this requirement.

ENGINEERING

Page Hall (Room 120)

The B. S. in Engineering degree offers an individualized academic program for those exceptional students who have academic and career goals that can not be accommodated by the other engineering degree programs. Before being admitted into the program, students must complete the freshmen year, have at least a 2.5 grade point average, have completed the course requirement for admission into an engineering degree program and have a plan of study approved by the student's advisory committee and the Dean. For information about the program, contact the Assistant Dean for Academic Affairs.

INDUSTRIAL ENGINEERING

Riddick Engineering Laboratories (Room 328)

Professor S. D. Roberts, Head

Lecturer C. L. Smith, Assistant Department Head

University Professor: S. E. Elmaghraby

Alumni Distinguished Undergraduate Professor: C. L. Smith

James T. Ryan Professor: A. L. Prak

Professors: M. A. Ayoub, R. H. Bernhard, S. C. Fang, T. J. Hodgson, H. L. W. Nuttle, P. J. O'Grady, R. G. Pearson, W. A. Smith, Jr., J. R. Wilson; Professors Emeriti: R. E. Alvarez, C. A. Anderson, J. R. Canada, R. W. Llewellyn; Associate Professors: C. T. Culbreth, Y. Fathi, R. E. King, E. T. Sanii, R. E. Young; Assistant Professors: H. Damerjil, M. G. Kav, G. A. Mirka, R. O. Mittal, J. Trevino; Lecturer: W. G. Morrissey.

INDUSTRIAL ENGINEERING CURRICULUM

The industrial engineer designs, improves, and installs integrated systems of people, materials, equipment, and information, drawing upon specialized knowledge and skill in the mathematical, physical and social sciences, together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results to be obtained from these systems. Productivity and effective utilization of resources, including energy conservation, are principle concerns of practitioners. The industrial engineer may develop operations or improvements for many diverse activities, such as a hospital, a department store, a manufacturing enterprise, an insurance office or government function. His or her position in an organization is usually as a management advisor in contact with every phase of the organization.

The curriculum blends a basic group of common engineering technical courses with specialized courses in the major areas of industrial engineering—design of human and machine systems, design of management control systems, and improvement of manufacturing operations. The course offerings stress mathematical and statistical techniques of industrial systems analysis; quantitative methodologies of operations research; computers as a tool for problem solving and simulation; economic considerations of alternatives; control of product or service quality and quantity; specifications of the manufacturing process including the equipment and tooling; and the utilization of safety and human factors engineering principles. The Industrial Engineering Program, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), leads to the degree of Bachelor of Science in Industrial Engineering.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 112 Intro to Comp. FORTRAN	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	4
ENG 111 Composition & Rhetoric	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		15
Human. Social Sci. Elec.	3		
PE 100 Health and Physical Fitness	1		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
IE 100 Intro. to Ind. Engr.	1	ECE 331 Prin. of Elec. Engr.	3
MA 242 Analyt. Geom. & Cal. III	4	GC 101 Engineering Graphics	2
MAT 201 Struc. & Prop. of Engr. Mtl.	3	IE 307 Process Control Computing	3
PY 208 Physics for Engrs. & Sci. II	4	IE 311 Engr. Economic Analysis	3
Human./Social Sci. Elec.	3	MA 341 Applied Diff. Eqns.	3
Physical Education Elective	1	ST 371 Intr. to Prob. & Distr. Theory	3
	16	Physical Education Elective	1
			18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 214 Engr. Mech. Statics	3	IE 352 Work Analysis & Design	3
ENG 331 Comm. for Engr. & Tech.	3	IE 401 Stochastic Models in IE	3
IE 351 Manufacturing Engr.	3	IE 443 Quality Control	3
IE 361 Deterministic Models in IE	3	IE 452 Ergonomics	3
ST 372 Intro. to Stat. Infer. & Regr.	3	Human./Social Sci. Elec.	3
Human./Social Sci. Elec.	3	Free Elective	3
	18		18

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 280 Managerial Accounting	3	IE 498 Sr. Project/Design Course	3
IE 308 Control of Prod. & Serv. Sys.	3	Engr. Science Electives	6
IE 441 Intro. to Simulation	3	Human./Social Sci. Elec.	3
IE 453 Facilities Design	3	Free Elective	3
Human./Social Sci. Elec.	3		15
Free Elective	3	Minimum Hours Required for Graduation	134
	18		

FURNITURE MANUFACTURING OPTION IN INDUSTRIAL ENGINEERING

The furniture industry in North Carolina manufactures products valued at over \$4 billion each year and supports an annual payroll of \$1.5 billion. The Bachelor of Science in Industrial Engineering, Furniture Manufacturing option, prepares graduates for both engineering and managerial positions in this industry. The curriculum offers industrial engineering students a concentrated study of the materials, products, and processes of the furniture industry. Scholarship support is available to students in the FM option through the Furniture Foundation and the American Furniture Manufacturers Association. Furniture companies provide summer and cooperative education jobs, and permanent employment opportunities exist on a national and international basis.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 112 Intro. to Comp./FORTRAN	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	4
ENG 111 Composition & Rhetoric	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		15
Human./Social Sci. Elec.	3		
PE 100 Health and Physical Fitness	1		
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GC 101 Engineering Graphics	2	ECE 331 Prin. of Elec. Engr.	3
IE 100 Intro. to Ind. Engr.	1	IE 241 Furn. Mfg. Processes I	3
IE 240 Furniture, Product Engr.	3	IE 307 Process Control Computing	3
MA 242 Analyt. Geom. & Cal. III	4	MA 341 Applied Diff. Eqns.	3
PY 208 Physics for Engrs. & Sci. II	4	ST 371 Intr. to Prob. & Distr. Theory	3
Human./Social Sci. Elec.	3	Physical Education Elective	1
Physical Education Elective	1		16
	18		

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
IE 311 Engr. Economic Analysis	3	CE 214 Engr. Mech. Statics	3
IE 340 Furn. Mfg. Processes II	3	ENG 331 Comm. for Engr. & Tech.	3
IE 352 Work Analysis & Design	3	IE 341 Furniture Plant Layout	3
IE 361 Deterministic Models in IE	3	IE 443 Quality Control	3
ST 372 Intro. to Stat. Infer. & Regr.	3	Human. Social Sci. Elec.	3
Human. Social Sci. Elec.	3		15
	18		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 280 Managerial Accounting	3	IE 498 Sr. Project Design Course	3
IE 308 Control of Prod. & Serv Sys	3	Engr. Science Electives	6
IE 441 Intro. to Simulation	3	Human. Social Sci. Elec.	3
IE 452 Ergonomics	3	Free Elective	3
Human. Social Sci. Elec.	3		15
	15	Minimum Hours Required for Graduation	128

MINOR IN INDUSTRIAL ENGINEERING

To obtain a minor in industrial engineering a student must complete a minimum of fifteen hours from courses given on the departmental list. Students wishing to complete the minor requirements must make application to the Department of Industrial Engineering and must meet the same academic criteria used for transfer applications.

MATERIALS SCIENCE AND ENGINEERING

Riddick Engineering Laboratories (Room 229)

Professor J. J. Hren, Head of the Department

Professor A. A. Fahmy, Director of Graduate Programs

Lecturer R. L. Porter, Undergraduate Coordinator

Kobe Steel Professor: R. F. Davis

University Distinguished Professor: J. Narayan

Kobe Steel Associate Professor: J. Glass

Alumni Distinguished Undergraduate Professor: R. L. Porter

Professors: K. J. Bachmann, J. R. Beeler, Jr., R. B. Benson, Jr., R. F. Davis, A. A. Fahmy, J. J. Hren, A. I. Kingon, C. C. Koch, K. L. Murty, J. Narayan, H. Palmour III, G. A. Rozgonyi, P. E. Russell, R. O. Scattergood, H. H. Stadelmaier; Research Professors: D. Maher, F. Shimura; Adjunct Professors: Y. Chen, G. McGuire, J. Prater, J. Roubort, I. Turlik; Professors Emeriti: W. W. Austin, H. Conrad, J. K. Magor, K. L. Moazed, R. F. Stoops; Associate Professors: C. M. Ballik, N. El-Masry, J. Glass; Research Associate Professor: J. Kaschaniula; Visiting Associate Professor: D. Griffiths, J. C. Russ; Adjunct Associate Professors: O. H. Auciello, K. Das; Associate Professor Emeritus: J. Hamme; Assistant Professor: R. J. Spontak; Adjunct Assistant Professor: J. Pothill; Lecturers: R. L. Porter, H. A. West; Adjunct Lecturers: C. Chiklis, C. Willis; Research Associates: T. M. Hare, A. Sprecher, Z. Radzinski; Associate Members of the Faculty: J. A. Bailey (Mechanical and Aerospace Engineering), S. Bedair (Electrical and Computer Engineering), K. S. Havner (Civil Engineering), Y. Horie (Civil Engineering), H. Lamb (Chemical Engineering), G. Lucovsky (Physics), R. J. Nemanich (Physics), A. Reisman (Electrical and Computer Engineering), I. Rovner (Sociology and Anthropology), V. T. Stannett (Chemical Engineering)

The Department of Materials Science and Engineering offers programs to qualify graduates for positions in industry, educational institutions, and governmental agencies which involve design, development, selection, and processing of engineered materials. Typical of the industries served by graduates in Materials Science and Engineering are: aerospace, chemical and chemical processing, communications, electronics, energy production, manufacturing and fabricating of metals (including the automotive industry), ceramics and abrasives, construction materials, nuclear, and transportation.

OPPORTUNITIES

The continuing industrial and technological growth of the United States and the Southeast in general and of the state of North Carolina in particular has been marked by a particularly strong demand for materials scientists and engineers. The pace of modern technological advances requires new materials and novel processing and/or fabrication methods. At the national level, materials research is prominently mentioned in most lists of critical or enabling technologies. As our understanding of materials science advances, common features and elements tend to unite many different industries. As an example, consider that our current knowledge of silicon is necessary in the electronics, photovoltaics, optical fiber technologies, lasers, pollution control, and biomedical industries. Advanced understanding of polymers also crosses and unites several different industries ranging from plastics, textiles, electronics, and recycling.

Professional preparation and education in materials science and engineering provides career opportunities in a wide range of industries from those which produce and/or use metals, glass, polymers, or ceramics, to those which use such materials in an integrated fashion such as the microelectronics industry. These opportunities include careers in research and development of new materials, new processes for producing them, failure analysis, product design and reliability, and technical management at all levels of business.

CURRICULUM IN MATERIALS SCIENCE AND ENGINEERING

The materials scientist and engineer must be able to deal with a wide range of phenomena that occur in all classes of materials: metals, ceramics, polymers, composites, and electronic materials. The undergraduate curriculum is designed to provide balance by addressing the scientific and engineering principles applicable to all classes of materials as well as the particular engineering and design concepts unique to each class of material. Further emphasis in a specific area is provided by choosing one technical elective dealing with processing (metallic or ceramic materials) and one technical elective dealing with specific applications (composite materials or electronic materials). The basic science elective allows students to gain more fundamental knowledge in either solid state theory, organic, or physical chemistry. The required senior design courses (MAT 423-424) serve as capstone courses and provide a strong preparation for dealing with real industrial situations; the first course covers open ended classroom exposures and participatory involvements in group dynamics and proposal preparation; the second course provides direct involvement with an industrial sponsor working on real problems submitted by industry. The remaining required courses are distributed among mathematics, physical sciences, and the humanities and social sciences.

The materials science and engineering program, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), leads to the degree Bachelor of Science in Materials Science and Engineering. A fifth year professional program is available for advanced study and further specialization. Graduate degrees are also offered (see listing of graduate degrees offered and consult the *Graduate Catalog*).

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 127 Chem. Principles & Appl. or	
CH 121 General Chemistry I Lab	1	CSC 110 112 Intro. to Comp.	3 4
E 100 Introduction to COE	0	ENG 112 Composition & Reading	3
E 115 Intro. to Computing Engr.	1	MA 241 Analyt. Geom. & Calculus II	4
ENG 111 Composition & Rhetoric	3	PY 205 Physics for Engrs. & Sci. I	4
MA 141 Analyt. Geom. & Calculus I	4	Physical Education Elective	1
Human. Social Sci Elec. ¹	3		
PE 100 Health and Physical Fitness	1		15 or 16
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 110/112 Intro. to Comp. or		CE 214 Engr. Mechanics Statics	3
CH 107/127 Chem. Principles & Appl.	3/4	ECE 331 Principals Electrical Engr.	3
MA 242 Analyt. Geom. & Cal. III	4	MA 341 Appl. Diff. Eqn.	3
MAT 201 Str. & Prop. Engr. Mats.	3	MAT 301 Equil. & Rate Processes	3
MAT 210 Exper. Mat. Sci. Engr.	1	Human./Social Sci. Elec. ¹	3
PY 208 Physics for Engrs. & Sci. II	4	Human./Social Sci. Elec. ¹	3
Physical Education Elective	1		
	16 or 17		18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 313 Mechanics of Solids	3	MAT 321 Phase Trans. & Diffusion	3
MAT 324 Polymer Char. Lab	1	MAT 331 Principals of Materials II	3
MAT 325 Intro. Polymeric Materials	4	MAT 434 Ceramic Engr. Lab	1
MAT 330 Principals of Materials I	3	MAT 435 Physical Ceramics I	3
MAT 410 Comp. Appl. Mats. Engr.	3	MAT 450 Mechanical Prop. Materials	3
Human./Social Sci. Elec. ¹	3	Free Elective	3
	17	Physical Education Elective	1
			17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAT 423 Intro. Matl. Engr. Design	3	MAT 424 Senior Design Proj.	3
MAT 430 Phys. Metallurgy Lab	1	MAT 491 Mats. Engr. Seminar ⁴	(1)
MAT 431 Physical Metallurgy I	4	MAT Technical Elective ⁵	3
MAT 491 Mats. Engr. Seminar ⁴	(1)	Human./Social Sci. Elec. ¹	3
MAT Technical Elective ⁵	3	Free Elective	3
Basic Science Elective ³	3 or 4	Free Elective	3
Human./Social Sci. Elec. ¹	3		
	17 or 19		15 or 16

Minimum Hours Required for Graduation 133

¹Humanities and Social Sciences courses to be selected from appropriate list approved by the College of Engineering.
²All students in Materials Science and Engineering must take both CH 107 and CH 127, and, either CSC 110 or CSC 112.

³Basic Science Elective (Select One): MAT 332 Prin. Materials III (3); CH 220 Organic Chemistry (4); or CH 437 Physical Chemistry for Engineers (4). It is suggested that if CH 220 or CH 437 is selected, it be taken in the fourth semester.

⁴MAT 491 Seminar may be taken either senior semester.

⁵MAT Technical Electives: Two technical electives (6 credits) are required from the four listed. These four courses are the only approved technical electives. One must be taken in the fall senior semester and one in the spring senior semester.

Senior Fall Semester take one:

MAT 311 Ceramic Processing I	3
MAT 440 Processing, Metallic Mats	3

Senior Spring Semester—take one:

MAT 460 Electronic Materials	3
MAT 556 Composite Materials	3

MINOR IN MATERIALS SCIENCE AND ENGINEERING

The minor in Materials Science and Engineering is designed to provide undergraduate engineering students and other science majors in curricula other than Materials Science and Engineering with the fundamentals of modern materials science and engineering necessary for advanced study in materials science and engineering and/or employment in materials related fields. The minor in Materials Science and Engineering offers a structured program that allows students to become familiar with the common features of all materials and to gain a deeper knowledge of at least one specific area of interest, including ceramics, polymeric, metallic, or electronic materials. This minor requires 16-17 hours of concentration consisting of ten hours of specified MAT courses (including MAT 201 and MAT 210) and 6-7 hours of additional courses. The GPA for the minor courses must be at least 2.0. For information concerning the minor, contact the Undergraduate Coordinator.

MECHANICAL AND AEROSPACE ENGINEERING

Broughton Hall (Room 3211)

Professor C. F. Zorowski, Head of Department

Professor F. R. DeJarnette, Associate Head of Department

Professor J. C. Mulligan, Director of Graduate Programs

Lecturer A. S. Boyers, Undergraduate Administrator

Alumni Distinguished Undergraduate Professors: E. M. Afify, M. A. Boles, R. R. Johnson

Alumni Distinguished Graduate Professors: M. N. Ozisik, F. R. DeJarnette

R. J. Reynolds Industries Professors: W. C. Griffith, C. F. Zorowski

Professors: E. M. Afify, J. A. Bailey, F. R. DeJarnette, T. A. Dow, J. A. Edwards, F. D. Hart, H. A. Hassan, T. H. Hodgson, E. G. Humphries, R. F. Keltie, C. Kleinstreuer, G. K. F. Lee, C. J. Maday, J. C. Mulligan, R. T. Nagel, M. N. Ozisik, J. N. Parkins, L. H. Royster, F. O. Smetana, F. Y. Sorrell, J. S. Strenkowski, W. D. Walberg, C. F. Zorowski; Adjunct Professors: J. M. Bownds, R. L. Bradow, C. T. Crowe, D. P. DeWitt, W. D. Erickson, G. Horvay, J. N. Jung, D. E. Klett, F. R. McClure, R. A. Whisman; Visiting Professor and Extension Specialist: M. M. Fikry, Professors Emeriti: R. A. Burton, M. H. Clayton, B. H. Garcia Jr., W. C. Griffith, F. J. Hale, J. K. Whitfield, J. Woodburn; Associate Professors: M. A. Boles, J. W. David, J. W. Eschen, R. R. Johnson, E. C. Kiang, J. W. Leach, D. S. McRae, L. M. Silverberg; Associate Professor and Extension Specialist: H. M. Eckerlin; Adjunct Associate Professors: J. P. Archie, R. W. Barnwell, J. F. Campbell, J. G. Cleland, P. D. Corson, D. L. Dwoyer, A. C. Eberhardt, R. M. Hall, J. H. Hebrank, K. R. Iyer, D. W. Lee, R. M. Potter, M. J. Ruiz, H. Singh, J. S. Stewart; Visiting Associate Professor: C. P. Young; Assistant Professors: N. Chokani, C. E. Hall, R. D. Gould, P. I. Ro, F. G. Yuan, M. A. Zikry; Adjunct Assistant Professors: G. V. Candler, P. L. Coe, M. M. Cohen, D. P. Colvin, J. A. Cooke, J. P. Coulter, J. U. Crowder, J. A. Dagherhart, P. A. Gnoffo, S. D. Ho land, M. A. Norees, A. L. Patra, T. W. Sigmon, S. E. Southward, K. Q. Sun, M. E. Tauber, M. A. Ward, W. J. Yanta; Visiting Assistant Professor: J. T. Warford; Lecturers: G. O. Batian, A. S. Boyers, G. M. Moorefield, R. J. Vess; Lecturer Emeritus: R. J. Leuba; Visiting Instructor: T. H. Brown; Adjunct Instructors: H. G. Hoamani, D. W. Lindley; Interdisciplinary Adjuncts: P. H. DeHoff, K. M. Whalley

Mechanical engineering deals with practical applications of mechanics and thermal sciences and comprises a wide range of activities including research; design and development; testing and experimentation; production implementation; manufacturing; operations; engineering sales and service; and management of engineering systems, subsystems and components. The diverse areas to which mechanical engineers contribute include transportation, power generation, energy conversion, environmental control, pollution abatement, manufacturing, and noise control. A recent trend in one phase of mechanical engineering has been increased interest in the areas of robotics, precision engineering, and automated manufacturing systems.

Aerospace engineering has grown out of the challenge of the design, construction, and operation of vehicles that move or travel above the earth's surface. These vehicles range from ground-effect machines and helicopters to aircraft, rockets, and spacecraft. The design of these vehicles is difficult not only because they must be lightweight but also because they must operate reliably and efficiently in a harsh environment. Every major class of thermal and mechanical system is included in aerospace vehicles. Moreover, the design requirements for spacecraft and high performance transport aircraft also apply to the next generation of ground transportation systems such as high speed trains, over-water transport, and automated motor vehicles.

FACILITIES

Laboratories include research facilities in acoustics, automotive engine pollution and performance, computer aided design and computer graphics, the effect of shock loading on materials, machine tool wear and mechanics, applied energy systems including a complete solar house, precision engineering, and boundary layers on airfoils. Undergraduate laboratories exist for the following courses and activities: mechanical engineering measurements, performance evaluation of mechanical engineering systems, senior projects in machine and system design, senior projects in aerospace vehicle design, and subsonic and supersonic wind tunnel testing and data analysis. Further, the department has a complete machine shop and electronics and instrumentation shop and related technicians.

OPPORTUNITIES

The flexibility and breadth of the mechanical engineering curriculum culminates in a broad range of employment opportunities in machinery and power related applications the world over. Mechanical engineers work at the heart of development of computer controlled devices, vehicles and production machinery. They are well qualified for employment in production or product planning and for industrial management. Many go into research and development after graduate study. The employment demand for graduates in mechanical engineering typically exceeds the supply and is among the highest of the various engineering departments.

Most graduates in aerospace engineering prefer to seek employment in the aerospace industry, however, they are broadly qualified for a variety of kinds of practice. The aerospace industry is one of the largest employers of engineers in the United States. Career and employment opportunities are available in the areas of aerodynamics, propulsion, structures and stability and control in both commercial and private aviation and in related aerospace industries.

CURRICULA

Because of the close relationship between mechanical and aerospace engineering, both curricula are administered by one department. There is cooperation between the two disciplines in which responsibility for subject areas such as thermodynamics, heat and mass transfer, vibrations, acoustics, fluid mechanics, propulsion and control theory is shared. Each program is designed to provide the student with an understanding of both the science on which the discipline is founded and the applied science and technology which characterizes its specific character. In addition the programs provide the student with an opportunity to develop the skills for applying his or her acquired knowledge. The Aerospace Engineering and the Mechanical Engineering programs, which are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), lead to the degrees Bachelor of Science in Aerospace Engineering, and Bachelor of Science in Mechanical Engineering, respectively. Graduate degrees are also offered (see listing of graduate degrees offered and consult the *Graduate Catalog*).

AEROSPACE ENGINEERING

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Chem Principles & Appl.	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	1
ENG 111 Composition & Rhetoric	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		15
PE 100 Health and Physical Fitness	1		
Human. Social Sci. Elec.	3		
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 112 Intro. to Comp. FORTRAN	3	GC 101 Engineering Graphics	2
MA 242 Analyt. Geom. & Calculus III	4	MA 341 Applied Differ. Equa.	3
MAE 206 Engineering Statics	3	MAE 208 Engr Dynamics	3
PY 208 Physics for Engrs. & Sci. II	4	MAE 261 Aero. Vehi Performance	3
Human. Social Sci. Elec.	3	MAE 314 Solid Mechanics.	3
Physical Education Elective	1	MAT 201 Struc. Prop. of Engr. Mat.	3
	18	Physical Educat on Elect ve	1
			18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ECE 331 Prin. of Elec. Engr.	3	MAE 356 Aerodynamics II	3
ECE 339 Prin. of Elec. Engr. Lab	1	MAE 358 Aerodynamics II Lab	1
MAE 301 Engr. Thermodynamics I	3	MAE 365 Propulsion I	3
MAE 355 Aerodynamics I	3	MAE 461 Dynamics & Controls	3
MAE 357 Aerodynamics I Lab	1	MAE 472 Aero. Struc. II	3
MAE 371 Aero. Struc. I	3	MAE 473 Aero. Struc. II Lab	1
Human./Social Sci. Elec.	3	Human./Social Sci. Elec.	3
	17		17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 455 Boundary Layer Theory	3	MAE 479 Aero. Vehi. Design II	3
MAE 462 Flight Vehi. Sta. & Cont.	3	Department Elective	3
MAE 465 Propulsion II	3	Human./Social Sci. Elec.	3
MAE 466 Propulsion II Lab	1	Free Elective	3
MAE 478 Aero. Vehi. Design I	2	Free Elective	3
Free Elective	3		15
Human./Social Sci. Elec.	3		16
	18	Minimum Hours Required for Graduation	134

MECHANICAL ENGINEERING

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 112 Intro. to Comp./FORTRAN	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introduction to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro. to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	4
ENG 111 Composition & Rhetoric I	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		15
PE 100 Health and Physical Fitness	1		16
Human./Social Sci. Elec.	3		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GC 101 Engineering Graphics	2	MA 302 Numer. Appl. to Diff. Eqn.	1
MA 242 Analyt. Geom. & Cal. III	4	MA 341 Appl. Diff. Eqns.	3
MAE 206 Engineering Statics	3	MAE 208 Dynamics	3
PY 208 Physics for Engrs. & Sci. II	4	MAE 314 Solid Mechanics	3
Human./Social Sci. Elec.	3	MAT 201 Struct. Prop. Engr. Matl.	3
Physical Education Elective	1	Human./Social Sci. Elec.	3
	17	Physical Education Elective	1
			17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ECE 331 Prin. of Elec. Engr.	3	IE 311 Engr. Econ. Analysis	3
MAE 301 Engr. Thermodynamics I	3	MAE 302 Engr. Thermodynamics II	3
MAE 305 ME Lab I	1	MAE 306 ME Lab II	1
MAE 315 Dynamics of Machines	3	MAE 308 Fluid Mechanics I	3
MAE 316 Strength of Mech. Comp.	3	MAE 310 Heat Trans. (Con. & Rad.)	3
Human./Social Sci. Elec.	3	Human./Social Sci. Elec.	3
	16		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 405 ME Lab III	1	MAE 412 Energy Systems	3
MAE 410 Conv. Ht. Trans. & Fluid Fl.	3	MAE 416 Mech. Engr. Design	4
MAE 415 Mech. Engr. Analysis	3	Dept. Elective	3
MAE 435 Prin. of Auto. Control	3	Free Elective	3
Free Elective	3	Human./Social Sci. Elec.	3
Free Elective	3		16
	16	Minimum Hours Required for Graduation	129

NUCLEAR ENGINEERING

Burlington Engineering Laboratories (Room 1110 B)

Professor D. L. Dudziak, Head of the Department

Professor R. P. Gardner, Coordinator of Advising

Alumni Distinguished Undergraduate Professor: K. Verghese

Professors: D. L. Dudziak, R. P. Gardner, J. G. Gilligan, K. L. Murty, P. J. Turinsky, K. Verghese, B. W. Wehring; Professors Emeriti: R. L. Murray, R. F. Saxe, E. Stam, L. R. Zumwalt; Associate Professor: J. M. Doster; Assistant Professors: D. Bullen, O. E. Hankins; Lecturer and Health Physicist: K. V. Mani; Associate Director of Nuclear Reactor Program: G. D. Miller; Nuclear Services Manager: J. N. Weaver.

Nuclear engineering is concerned with the engineering aspects of the control, release and utilization of nuclear energy from both fission and fusion. Nuclear reactors serve many functions—they serve as heat sources for electric power plants, are the basis of modern propulsion systems for ships and submarines, and produce fissionable and radioactive isotopes for a variety of peaceful applications. Nuclear methods are applied in medical diagnosis and treatment, scientific research, and the search for new resources. The Nuclear Engineering program educates individuals in scientific and engineering principles essential for effective and productive contributions in industrial, university and government service. The Nuclear Engineering program, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), leads to the degree Bachelor of Science in Nuclear Engineering.

OPPORTUNITIES

Nuclear power reactor construction continues with over one hundred reactors now operating in the nation, increasing our reliance upon nuclear energy as a substitute for energy from fossil fuels. Development of breeder and fusion reactors offers the potential of vast new energy sources. Industrial and medical applications of radiation continue to increase in diverse industries. A demand for nuclear engineers exists within the electric power industry and national laboratories.

SCHOLARSHIPS AND AWARDS

Several special scholarships exist for NCSU Nuclear Engineering students, including the Bechtel, Carolina Power and Light, Ebasco, Eastern Carolinas ANS, Institute for Nuclear Power Operations, and American Nuclear Society scholarships. A special department fund supports scholarships for incoming freshmen. NCSU Nuclear Engineering students have gained national recognition by several times receiving the Student Design Award of the American Nuclear Society and being recipients of nationally awarded fellowships.

FACILITIES

Facilities for nuclear education include: a nuclear research reactor (PULSTAR), which can be operated at a steady state power of 1 MW; the Scaled Pressurized Water Reactor facility (SPWR), an operating 1/9 scale model of a nuclear power plant; radiation detectors and multi-channel analyzers; nuclear materials laboratory; thermal hydraulic laboratory; prompt gamma facility; neutron radiography unit; numerous computer facilities including graphic terminals, access to the NCSU IBM 3090 supercomputer and the North Carolina Supercomputing Center CRAY Y-MP, an Alliant FX/4 parallel mini-supercomputer, numerous departmental computer workstations, several College of Engineering EOS engineering workstations, and microcomputers (PCs); fusion laboratory; neutron activation analysis laboratory, and high- and low-level radiochemistry laboratories.

CURRICULUM

Nuclear engineers work in nuclear systems research, design, development, testing, operation, environmental protection, and marketing. The Bachelor of Science program prepares graduates for positions in industry, national laboratories, or for graduate study (see listing of graduate degrees offered). The curriculum incorporates basic sciences and engineering, with emphasis on mathematics and physics, followed by coursework in nuclear science and technology. Attention is given to the engineering design of nuclear reactors and nuclear radiation systems and to energy resources and environmental aspects of nuclear energy. Computers are widely used through the curriculum.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Chem. Principles & Appl.	3
CH 121 General Chemistry I Lab	1	CH 127 Chem. Principles Lab	1
E 100 Introduction to COE	0	ENG 112 Composition & Reading	3
E 115 Intro. to Computing Envr.	1	MA 241 Analyt. Geom. & Calculus II	4
ENG 111 Composition & Rhetoric	3	PY 205 Physics for Engrs. & Sci. I	4
MA 141 Analyt. Geom. & Calculus I	4	Physical Education Elective	1
Human./Social Sci. Elec.	3		16
PE 100 Health and Physical Fitness	1		
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 112 Intro. to Comp./FORTRAN	3	CE 213 Intro. to Mechanics	3
MA 242 Analyt. Geom. & Calculus III	4	MA 341 Applied Differ. Equa.	3
NE 201 Intro. to Nucl. Engr.	2	NE 202 Fundamentals of Nuc. Energy	4
PY 208 Physics for Engrs. & Sci. II	4	PY 407 Intro. Mod. Physics	3
Human./Social Sci. Elec.	3	Human./Social Sci. Elec.	3
	16		16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ECE 331 Prin. of Elec. Engr.	3	MA 401 Appl. Diff. Eqns. II	3
MAE 301 Engr. Thermodynamics I	3	MAT 201 Struct. Prop. Engr. Matl.	3
MAE 308 Fluid Mechanics	3	NE 302 Nucl. Reac. Engr. Conv.	4
NE 301 Fund. of Nuclear Engr.	4	NE 401 Reactor Analyt. & Design	4
Physical Education Elective	1		14
	14		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
NE 402 Reactor Engineering	4	NE 403 Nucl. Engr. Design Project	3
NE 404 Rad. & Reactor Safety	3	NE 409 Nuclear Materials	2
NE 405 Reactor Systems	3	Approved NE Elec.	3
Human./Social Sci. Elec.	3	Human./Social Sci. Elec.	3
Physical Education Elective	1	Human./Social Sci. Elec.	3
	14		14

Minimum Hours Required for Graduation 120

TEXTILE ENGINEERING

(Also see "College of Textiles")

Textile Building Centennial Campus (Room 3250)

Professor C. D. Livengood, Head of the Department of Textile Engineering, Chemistry, and Science

Professor B. S. Gupta, Assistant Head

Professor K. R. Beck, Assistant Head

Professor T. G. Clapp, Program Director

(For a list of faculty, see "Textile Engineering, Chemistry, and Science")

The textile and related industries represent a major part of the manufacturing segment of the American economy with the industry mainly concentrated in the Southeast. The textile industry of North Carolina comprises approximately one fourth of the United States textile industry. Textile and related industries in North Carolina represent 40-50% of the industrial employment. The value of textile products alone produced in North Carolina totals some \$13 billion a year.

The textile industry is rapidly changing to become a capital intensive, high-technology industry. Applications of computers and robotics are commonplace in the modern plant. Textile engineering is concerned with the application of scientific principles and engineering practice to the design and control of all aspects of fiber, textile and apparel processes, products and machinery.

The Textile Engineering program, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), leads to the degree of Bachelor of Science in Textile Engineering.

FACILITIES AND SCHOLARSHIPS

(See "College of Textiles")

OPPORTUNITIES

Because the modern production and utilization of textile materials require young people highly competent in the areas of engineering, mathematics, science and technology, graduates of the program are prepared for challenging careers in the primary textile, man-made fiber, apparel and nonwovens industries, as well as the textile machinery, automotive, aerospace and construction industries. Opportunities abound in plant engineering, quality engineering, production control, process engineering, and product development.

TEXTILE ENGINEERING CURRICULUM

The Textile Engineering program investigates how scientific principles and engineering practices can be applied to the diverse requirements of textile materials, processes, structures and machinery. The program combines study of textile, physical, mathematical and social sciences with engineering analysis and design techniques. Students study the interaction of fibers and fabrics with machinery, as well as consider such issues as quality, safety, process control and project management. Completion of a B.S. in Textile Engineering provides the individual with a broad engineering background suited to addressing textile engineering problems. Since training in textile engineering involves two distinct technical fields—textiles and engineering—the curriculum is a joint responsibility of the two colleges and is so administered.

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 112 Intro. to Comp. FORTRAN	3
CH 121 General Chemistry I Lab	1	ENG 112 Composition & Reading	3
E 100 Introductor to COE	0	MA 241 Analyt. Geom. & Calculus II	4
E 115 Intro to Computing Envr.	1	PY 205 Physics for Engrs. & Sci. I	4
ENR 111 Composition & Rhetoric	3	Physical Education Elective	1
MA 141 Analyt. Geom. & Calculus I	4		15
PE 100 Health and Physical Fitness	3		
Human. Social Sci. Elec.	3		
	16		

SOPHOMORE YEAR

<i>Fa Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GC 101 Engineering Graphics	2	MA 341 Appl. Diff. Eqns.	3
MA 242 Analyt. Geom. & Cal. III	4	MAE 208 Engineering Dynamics	3
MAE 206 Engineering Statics	3	MAE 314 Solid Mechanics	3
PY 208 Physics for Engrs. & Sci. I	4	ST 361 Intro. to Statistics for Engr.	3
Free Elective	3	TE 201 Polymr. & Fiber Sci. & Engr.	4
Physical Education Elective	1	Human. Social Sci. Elec.	3
	17		19

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ECE 331 Prin. of Elec. Engr. I	3	ECE 332 Prin. of Elec. Engr. II or	
MAE 301 Engr. Thermodynamics I	3	MAE 435 Prin. of Auto. Controls	3
MAE 308 Fluid Mechanics I	3	ENG 331 Comm. for Engr. & Tech.	3
TE 301 Textile Mfg. Process I	4	TAM 380 Mgmt. & Cont. of Tex. Sys.	3
Human. Social Sci. Elec.	3	TE 302 Textile Mfg. Process II	4
Physical Education Elective	1	Human. Social Sci. Elec.	3
	17	Free Elective	3
			19

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TE 303 Textile Chem. Process	4	TE 402 Textile Engr. Design II	4
TE 401 Textile Engr. Design I	4	TE 404 Textile Quality Control	4
TE 403 Mechanics Fiber Structure	3	Human. Social Sci. Elec.	3
Engineering Elective	3	Free Elective	3
Human. Social Sci. Elec.	3		14
	17	Minimum Hours Required for Graduation	134

PROFESSIONAL DEGREES

The College of Engineering offers professional curricula leading to the degrees of Chemical Engineer, Civil Engineer, Electrical Engineer, Industrial Engineer, Materials Engineer, Mechanical Engineer, and Nuclear Engineer. This program is designed for engineering students holding baccalaureate degrees who find that an additional year of education is desirable, for practicing engineers who desire to take a year of professional work to update their training, and for students holding physical sciences or mathematics degrees who seek a professional level of education in engineering. The program is intended to be sufficiently flexible to meet a wide variety of student needs, and to emphasize professional course work. The curriculum consists of a minimum of 30 hours of credit at the 400 level or above, including at least 15 hours of credit at the 500 level or above.

Applicants who hold the bachelor's degree in engineering, physical sciences, or mathematics may be admitted to the professional program of the College of Engineering upon application and presentation of official credentials. For unconditional admission, these credentials must show a minimum grade point average of 2.5 overall. Admission on a provisional basis may be granted to applicants who do not meet the formal requirements. In the case of insufficient preparation, prerequisite courses will be prescribed in addition to the normal fifth-year requirements.

The following requirements of the College of Engineering will be observed:

1. Professional degree students are admitted through the Undergraduate Admissions Office as fifth-year professional degree (PR) students. They are subject to rules and regulations as established and administered by the Dean of the College of Engineering.
2. Application forms for admission to the professional degree program should be completed and submitted to the Assistant Dean for Academic Affairs at least 60 days in advance of the semester in which admission is sought. Acceptance of a student for the professional program is based on the recommendation of the student's department and the approval of the Assistant Dean for Academic Affairs. At the time of acceptance, NCSU students may transfer a limited number of excess credits to their professional program.
3. A limited amount of credit to be applied toward the requirements for the professional degree may be transferred to NCSU from recognized institutions offering advanced work in engineering and related fields. Such a transfer of credit must be approved by the department in which the student does his or her major work and by the Dean of the College of Engineering.
4. A graduate in one field of engineering may choose to work for a professional degree in another field provided he or she has the permission of the department. The student will be expected to take necessary prerequisite courses in addition to those required for the professional degree program.
5. Each fifth-year student will be assigned to an advisor in the sponsoring department. The function of the advisor is to assist the student in preparing a program of study and to counsel the student with regard to his or her academic work. Prior to the midterm of the first semester, the student and his or her advisor should agree on a program of study for the professional degree. Program of Study for Professional Degree forms will be prepared and submitted to the office of the Assistant Dean for Academic Affairs as well as to the department. Upon approval of the Office of the Dean, this becomes the student's degree program.
6. Grades for each completed course are reported to the Dean of the College of Engineering and to Registration and Records. A minimum grade of "C" must be made in each course to obtain credit. A quality point average of 2.5 in all course work must be maintained to satisfy requirements for a professional degree.
7. All courses taken by the student after admission to the professional program will count toward the overall grade point average even though an individual course may not be a part of the degree program.
8. A student who falls below 2.5 average will be placed on probation and given one semester to raise the overall average up to a 2.5. If the student has been admitted on a provisional basis, he or she must make a 2.5 average the first semester in order to continue.
9. Work completed more than six years prior to the date on which the professional degree is to be granted may not be used as credit toward the professional degree, unless approved by the head of the department concerned and the Assistant Dean for Academic Affairs.
10. A professional degree student who has been admitted to the Graduate School may, with the approval of a Master's Degree committee and the Graduate School, transfer nine hours of credit for courses in which a grade of "B" or higher was received.
11. A student may transfer only once, that is, from the Professional Degree Program to the Graduate School or from the Graduate School to the Professional Degree Program. Therefore, a student is not permitted to return to either program after having transferred from that degree program.
12. It is intended that professional degree students will complete a substantial portion of credit hours toward the degree while in residence on the NCSU campus.

COLLEGE OF FOREST RESOURCES

Biltmore Hall (Room 2028)

L. W. Tombaugh, *Dean*

J. D. Wellman, *Associate Dean for Academic Affairs and Coordinator of Advising*

R. Lea, *Associate Dean for Research*

K. Martin, *Assistant to the Dean for Academic Affairs and Lecturer*

A. S. Coughlin, *Director of Educational Outreach*

C. D. Argentati, *Natural Resources Librarian*

The mission of the College of Forest Resources is to develop high impact professionals, new ideas, and technology to assure that natural resource based enterprises are managed in ways that are economically sound and environmentally sustainable. This mission is pursued through programs of undergraduate and graduate instruction, research, and extension.

The College of Forest Resources is the only unit in the University of North Carolina System that combines accredited programs in forestry, wood and paper science, and recreation and park management. It thus has a unique responsibility to provide the leadership, the science, and the technology that will contribute to improved management of renewable natural resources, more productive and competitive resource based enterprises, and an improved quality of the environment.

Renewable natural resources serve three broad purposes, and these purposes define the programs of the College of Forest Resources.

First, forests and related natural resources provide goods and services that are useful to society and that provide the basis for industrial activities, jobs, and income. The College has a special mission to provide well educated personnel, new technology, and service to the forest products industry—an industry that adds \$73,000,000,000 to the value of the U.S. economy each year and that employs nearly 9% of all people working in U.S. manufacturing. This industry is particularly important to the economy of our state. It ranks second in terms of manufacturing employment in North Carolina, and its products include pulp and paper, lumber, plywood, particleboard, and furniture. An important part of our mission is to contribute to the efficiency and profitability of forest products enterprises while assuring the continued availability of raw materials and productive forests in the long run.

The second use of renewable natural resources—forests, wildlife, open spaces—is for leisure time activities. Whether enjoyed in urban settings or in national parks and forests, leisure time experiences are essential to the overall quality of life in an increasingly technological society. The College prepares professionals to deal with planning, organizing, and managing parks, recreation and sports programs, and commercial recreation and tourism facilities.

Finally, natural resources interact in complex ways to produce a finely woven, delicate web of ecological relationships. It is not just the quality of life, it is in some instances life itself that will depend on our capability to understand and maintain a harmonious relationship with the natural environment. All departments within the College conduct teaching, research, and extension activities directed to understanding and contributing to the maintenance of a high quality environment.

DEGREE PROGRAMS

The College of Forest Resources offers programs of study leading to baccalaureate and graduate degrees in the management and use of natural resources and offers courses in the same arena to students in other colleges. Five professional curricula are administered in the College through its Departments of Forestry; Parks, Recreation and Tourism Management; and Wood and Paper Science, and a sixth is offered through joint administration of the Fisheries and Wildlife Sciences Program with the College of Agriculture and Life Sciences. These programs provide a broad education in the biological, physical, and social sciences as well as a sound cultural and professional background.

Baccalaureate degrees prepare students for careers in the fields of fisheries and wildlife sciences; forest management; natural resources assessment and management; parks, recreation and tourism management; pulp and paper science and technology; and wood products.

Graduate degrees offered include: Master of Science, Master of Forestry, Master of Parks, Recreation and Tourism Management, Master of Wood and Paper Science, and the Doctor of Philosophy. Graduate degree programs may be tailored to a variety of specialized and interdisciplinary topics related to the teaching and research activities of the College. Applicants should consult the *Graduate Catalog* for additional information about these programs.

COMPUTER COMPETENCY

Extensive use of microcomputers and workstations is incorporated throughout all curricula of the College of Forest Resources. Each program begins with a basic course in computer competency in the freshman year, and students are expected to use the computer for increasingly complex class assignments and for the preparation of papers and reports. Computing resources are available for student use in the College and elsewhere on campus, but many students find it advantageous in terms of convenience to purchase a personal computer. The College has arranged for personal computer lease or purchase through the NCSU Bookstores. Questions about such a purchase should be directed to the Associate Dean of Academic Affairs or the appropriate departmental curriculum coordinator.

FIELD INSTRUCTION AND WORK EXPERIENCE

All curricula in the College have strong components of hands-on field and laboratory instruction and experience, and all either require or strongly recommend voluntary on-the-job work experience. All students (except those in Natural Resources concentrations) are required to complete the equivalent of one or more of the following summer activities: (1) camp; (2) internship; (3) practicum; (4) work experience. The Forest Management and Fisheries and Wildlife curricula both have required summer camps. Undergraduates enrolled in Parks, Recreation and Tourism Management complete a nine-week internship immediately following the completion of the junior year. All Pulp and Paper majors spend at least one summer working in an industrial setting designated by the College. Wood Products students attend a summer practicum following the sophomore year. Students in all curricula may also participate in summer jobs and the cooperative education program to gain work experience.

Local field trips are a regular part of many courses. Additional field instruction and scheduled trips to representative industries and agencies are frequently required as a part of regular class assignments.

HONORS AND SCHOLARS PROGRAMS

The College of Forest Resources participates in the University Scholars Program in which exceptional new students (freshman or transfer) are selected for special courses and activities that provide an expanded educational experience.

The purpose of the College of Forest Resources' Honors Program is to offer the opportunity for advanced students with outstanding records to enhance the depth of study in their major field. Students with an overall GPA of at least 3.25 after 40 or more credit hours will

be invited to enter the Honors Program. Honors students develop more rigorous programs of study, frequently taking advanced courses in mathematics, science, or social science or graduate courses in the chosen curriculum. With the adviser's consent honors students may substitute preferred courses for normally required courses in order to develop strength in special interest areas. Honors students are required to undertake a program of independent study which can involve a research problem or special project during their junior or senior year, and they must participate in the senior honors seminar.

Two honor societies in the College of Forest Resources promote and recognize academic excellence: Xi Sigma Pi (for all majors within the college) and Rho Phi Lambda (for recreation majors). Advanced undergraduate and graduate students with high academic achievement are invited to become members of these societies. High achieving forest management and natural resources students are also eligible for recognition by two agriculture honor societies, Alpha Zeta and Gamma Sigma Delta. All students are also eligible for recognition by the campus wide honor societies.

SCHOLARSHIPS

The College of Forest Resources administers a large program of academic scholarships that is separate from the University Merit Awards Program. Academic scholarships (ranging from \$1,000 to \$4,000 per year) and renewable annually are awarded in several program areas to entering freshmen and transfer students. The appropriate departments accept applications, and based on academic excellence, and leadership, award the scholarships that are administered through the North Carolina Forestry Foundation and the Pulp and Paper Foundation. The awards include a total of over 100 scholarships for students in the Forest Management, Natural Resources, Parks, Recreation and Tourism Management, Pulp and Paper Science and Technology; and Wood Products and Technology curricula.

INTERNATIONAL ACTIVITIES

Students in the College of Forest Resources are exposed to the international dimensions of their programs in a variety of ways. Many faculty members regularly travel abroad and several are active in major projects in foreign countries, including an international cooperative research project concentrating on Central America and Mexico and a faculty exchange program with Sweden. With that faculty experience, the international aspects of many topics are covered in core courses, and several elective undergraduate and graduate courses focus specifically on the international dimensions of natural resource management. In addition, many international students enroll in the College, with as many as 21 different countries represented in recent years.

STUDENT ACTIVITIES

Each department in the College has a student curriculum club and or student chapter of the appropriate national professional organization. All of these organizations provide opportunities for professional development, for interaction with faculty and other students, and for participation in local, regional, and national student and professional activities. Student representatives from each organization and curriculum serve on the College of Forest Resources Council. The Council provides overall coordination for student activities, allocates funds for student activities, and oversees production of the *Pinetum*, the College of Forest Resources' student yearbook.

FACILITIES AND LABORATORIES

In addition to standard classrooms and teaching laboratories, the College of Forest Resources has a unique complex of indoor and field facilities that are utilized in the academic programs. Computer facilities include a general microcomputer lab, two labs with microcomputers and workstations for applications in geographic information systems and remote sensing, and network access to the University mainframe computer. Also available are several different analytical and biotechnology facilities, a photo interpretation lab, an extensive herbarium, and a wood sample collection. Facilities for field instruc-

tion and projects include 80,000 acres in forest: the Hofmann Forest on the Coastal Plain; the Hill, Schenck, Hope Valley and Goodwin Forests in the Piedmont; and the Slocum summer camp at the Hill Forest in Durham county. Specialized laboratories unique to wood products programs are contained in the Hodges Wood Products Laboratory and the Reuben B. Robertson Pulp and Paper Laboratory. Equipment in the Hodges Laboratory includes computer controlled woodworking machinery, dry kilns, sawmill veneer lathe and numerous other items required to convert wood into products. The Robertson Laboratory is a 50,000 sq. ft. facility which contains laboratories and modern pulping and papermaking equipment dedicated to teaching and research activities. Examples of equipment are secondary fiber recycling equipment, a thermo mechanical pulping unit, paper machine, process control equipment, paper testing laboratory, and pulping digesters.

FORESTRY

Biltmore Hall (Room 2018)

Professor Arthur W. Cooper, Head of the Department

Associate Professor James D. Gregory, Assistant Department Head for Undergraduate Programs

Professor D. Lester Holley, Assistant Department Head for Graduate Programs and Director of Graduate Programs

Distinguished University Professor: E. B. Cowling

Alumni Distinguished Undergraduate Professor: R. R. Braham

Alumni Distinguished Graduate Professor Emeritus and Carl Alwin Schenck Professor Emeritus: C. B. Davey

Edwin F. Conger Distinguished Professor Emeritus: B. J. Zobel

*Professors: D. A. Adams, H. L. Allen, Jr., F. E. Bridgwater (USFS), R. I. Bruck, S. W. Buol, A. W. Cooper, E. B. Cowling, F. W. Cubbage (USFS), P. D. Doerr, E. C. Franklin, D. J. Frederick, L. F. Grand, A. E. Hassan, D. L. Holley, Jr., J. B. Jett, R. C. Kellison, S. Khorrarn, J. G. Laarman, R. A. Lancia, R. Lea, J. R. McGraw, G. Namkoong (USFS), R. L. Noble, R. R. Sederoff, A. G. Wollum; *Adjunct Professors: G. L. DeBarr, G. F. Dutrow, P. Farnum, J. D. Hair, N. E. Johnson, J. R. Jorgensen, A. Krochmal, S. Linder, D. A. MacKinnon, P. A. Sanchez, R. W. Stonecypher, W. E. Towell, C. G. Wells; Professors Emeriti: R. C. Bryant, C. B. Davey, M. H. Farrier, W. L. Haffey, R. D. Hazel, W. T. Huxster, W. M. Keller, W. D. Miller, T. O. Perry, R. J. Preston, L. C. Saylor, F. E. Whitfield, B. J. Zobel; Associate Professors: R. C. Abt, H. V. Amerson, R. R. Braham, J. E. deSteiguer (USFS), P. M. Dougherty (USFS), W. S. Dvorak, J. D. Gregory, L. H. Harkins, L. G. Jarvis, E. J. Jones, S. E. McKeand, J. P. Roise, A. M. Stomp, R. J. Weir; *Adjunct Associate Professors: W. J. Barton, D. L. Bramlett (USFS), R. G. Campbell, R. G. Haight (USFS), C. C. Lambeth, C. B. Webb, J. N. Woodman; Associate Professor Emeritus: E. M. Jones; Assistant Professors: G. B. Blank, J. A. Collazo, L. T. Henry, B. Liu, D. M. O'Malley, J. A. Richmond (USFS), W. D. Smith, R. W. Whetten; *Adjunct Assistant Professors: M. C. Conner, L. J. Frampton, T. P. Holmes (USFS), W. E. Ladrach, R. B. McCullough, R. C. Purnell, G. A. Ruark (USFS), M. M. Schoeneberger (USFS), H. K. Steen, D. N. Wear (USFS), C. G. Williams; *Instructor: J. L. Bettis; Adjunct Instructor: R. W. Slocum; Specialists: W. E. Gardner, R. A. Hamilton, M. A. Megalos, J. Sidebottom; Liaison Geneticist: J. R. Sprague; Research Associates: J. A. Brockhaus, B. L. Conkling, J. K. Donahue, E. M. Lunk, A. D. Sampson, T. H. Shear; Research Assistants: T. J. Albaugh, H. M. Cheshire, S. R. Colbert, F. Eastman, C. S. Furness, D. N. Hazel, S. Horton, A. S. Tohmas, R. A. Wilson, M. J. Young; Associate Members of the Faculty: P. T. Bromley (Zoology), H. A. Devine (Recreation Resources), W. J. Fleming (Zoology), F. B. Hain (Entomology), L. E. Hinesley (Horticultural Science), D. E. Moreland (USDA-Crop Science), R. A. Powell (Zoology), J. D. Wellman (Forestry).*****

The undergraduate program of the Department of Forestry prepares students for professional challenges, personal growth, and a lifetime of service as managers of renewable natural resources. The curricula endeavor to produce well educated forestry and natural resources graduates who have the basic knowledge, skills, flexibility, and attitude needed for successful professional performance in a wide variety of career opportunities. Graduates will be prepared to face the challenges of competing uses of natural resources and the environment, and the pressures for increasing production of goods and services from

natural ecosystems while maintaining their quality for future generations. The Department of Forestry strives to enroll and graduate a high quality, culturally and racially diverse student body to enhance the diversity and richness of forestry and natural resources professionals. Its academic curricula are enriched by out-of-class contacts among students, faculty, and practicing professionals, which promote a sense of professionalism and professional community. Gaining practical experience is encouraged through participation in summer employment and the cooperative education program.

The department has three Bachelor of Science (BS) degree programs: Forest Management, Natural Resources Ecosystem Assessment, and Natural Resources Policy and Administration. The Forest Management curriculum provides the broad-based forestry education needed for direct employment into positions in a wide variety of forestry or forestry related organizations. The Natural Resources curricula provide more generalized, interdisciplinary programs in natural resources management that focus on the areas indicated in the curriculum titles.

Instruction and practice in communications skills (both writing and speaking) are integrated into the required forestry (FOR) courses throughout the Forest Management curriculum and to a lesser extent in the forestry (FOR) and natural resources (NR) courses of the Natural Resources curricula that are taught in this department. The communications across the curriculum program produces graduates who are highly competent and confident in the communication skills needed by successful natural resource managers.

The use of computers is integrated into the curricula in a similar fashion. Introductory instruction in the use of microcomputers is provided in CFR 134 and practical assignments on the use of computers as a tool in natural resource management are integrated into the advanced courses of all three curricula.

Information on department programs may be obtained by contacting Ms. Kris Martin, College of Forest Resources Recruiting Coordinator, NCSU, Box 8001, Raleigh, NC 27695-8001, (919) 515-5510 or Dr. James D. Gregory, Assistant Head for Undergraduate Programs, Department of Forestry, NCSU, Box 8002, Raleigh, NC 27695-8002, (919) 515 7567.

SCHOLARSHIPS

The Department of Forestry annually awards four types of scholarships that are available to freshmen, transfers, and advanced students: Academic, Forestry Summer Camp, Industrial and Work Study. About 30 Academic Scholarships of \$1500 each are awarded annually in April for the following academic year and are renewable provided that superior progress is made toward a degree. Five endowments provide these awards: John M. and Sally Blalock Beard, Edwin F. Conger, Hofmann Forest, James L. Goodwin, and Jonathan Wainhouse Memorial.

Four scholarships are available each year to students attending Forestry Summer Camp. Two scholarships are awarded in April to students attending the next camp and two are awarded after camp to the students who exhibited superior academic and professional skills while at camp. Two endowments provide these awards: Ralph C. Bryant and Maki Gemmer-Johnson.

Three Industrial Scholarships are available each year. In addition to cash awards, the Industrial Scholarships provide practical work experience with industrial forestry organizations. Industrial Scholarships are supported by grants from Canal Wood Corporation, Chesapeake Corporation, and the North Carolina Forestry Association.

About 12 Work Study Scholarships are awarded each year, generally to juniors and seniors. Work Study Scholarships, currently at \$1500 each, carry a work requirement which is usually satisfied by assisting with operational activities on the college forests. This requirement means that recipients must be advanced students with some field skills. Three endowments provide these awards: Biltmore Forest, James L. Goodwin, and George K. Slocum.

Scholarship applications or questions should be directed to Dr. Richard Braham, Forestry Scholarship Coordinator, (919) 515-7568.

COOPERATIVE EDUCATION AND SUMMER WORK EXPERIENCE

Practical work experience is an important component of the professional degree programs in the Department of Forestry. That experience may be gained through participation in the Cooperative Education Program or through summer work experience. The department has close ties with a number of employers in the field of forestry and natural resources and provides placement assistance for the work experience programs. The Cooperative Education Program, which requires a minimum 2.25 GPA after at least one year of study for participation (many employers require a higher minimum), involves alternating semesters or summer periods on the job with semesters on campus for classes. A total of 12 months of work experience is required. Students who successfully complete the "coop" program are in high demand by employers. Interested students should contact the department placement officer, Mr. Larry Jervis, (919) 515-7576.

DUAL DEGREE PROGRAMS

Students in Forestry or Natural Resources who have a strong interest in another degree topic may obtain a second baccalaureate degree in addition to the primary one. Such dual degree programs may be designed to provide a broader base in a related technical field such as Wood Science and Technology, Fisheries and Wildlife Sciences, or Soil Science or to broaden the student's knowledge and skills in a supporting field such as Business, Economics, Sociology, or Political Science. Joint programs require coordination of the courses required in both curricula and the additional time required to complete them depends on the similarity between the curricula and the use of electives in one to satisfy required courses in the other. One to several extra semesters may be required to complete two degrees but expanded employment opportunities are a definite benefit.

TRANSFER STUDENTS

The Department of Forestry accepts NCSU students in good academic standing and students from other accredited colleges and universities with good academic records (minimum 2.5 GPA on a 4.0 scale is preferred) as transfers into its curricula. Students at community colleges, junior colleges, or other baccalaureate institutions who plan to transfer to one of the department's degree programs should closely follow the desired curriculum by taking the equivalent courses available. Only equivalent courses will be credited to the appropriate degree program after enrolling at NCSU, and the time required to complete the degree will depend on the courses remaining in the degree track. Students applying for the Forest Management curriculum who have upwards of 45 credits equivalent to those in the freshman and sophomore years must transfer here at least one semester prior to entering summer camp. Questions about transfer procedures or courses should be directed to Dr. James D. Gregory, Assistant Department Head for Undergraduate Programs, (919) 515-7567.

CURRICULUM IN FOREST MANAGEMENT

The curriculum in Forest Management is a professional program accredited by the Society of American Foresters that has long been ranked as one of the best among the 45 such programs in the country. With a rigorous math and science base, the curriculum produces graduates with a broad education in the natural sciences, humanities and social sciences, communications skills, computer competency, and the technical knowledge and skills needed for sound management of the multiple resources of natural and managed forest ecosystems. Preparatory courses in the freshman and sophomore years are followed by the 10 week forestry summer camp where the woods knowledge and field skills that are essential for all foresters are acquired. Core courses of the junior and senior years focus on forest ecosystem processes, applied economics, operational practices in forest stand management, measurement and analysis of forest stand components, policy issues in natural resource management and the management decision-making tools and skills needed to develop and implement forest management plans.

OPPORTUNITIES

Graduates in Forest Management are in demand by state and federal land-managing agencies, by industrial concerns growing wood as raw material, by state forestry and agriculture extension services, by forestry related organizations such as nurseries and landscape management firms, and by urban natural resource management agencies. Some graduates, after acquiring professional forestry experience, are self-employed as consultants and as operators or owners of forestry related businesses. Several recent graduates have become high school teachers, some have joined the Peace Corps, some are working in forestry related sales and marketing and in financial management and others have joined environmental consulting firms. Many, of course, go on to graduate school to specialize in a wide variety of forestry and related programs.

FORESTRY SUMMER CAMP

An intensive full time 10 week long summer camp experience, with forestry field training in the Coastal Plain, Piedmont, and Mountain regions of North Carolina is required in the Forest Management curriculum. The camp is based at the College's Hill Demonstration Forest with trips taken to other regions. Students take the summer camp after completion of the sophomore year and earn 10 semester credits for courses that provide a base of knowledge and skills for the advanced courses to come.

FOREST MANAGEMENT CURRICULUM

FRESHMEN YEAR			
Fall Semester	Credits	Spring Semester	Credits
BS 100 General Biology	4	CH 101 General Chemistry I	3
CFR 134 Comp in Natural Resources	1	CH 121 General Chemistry Lab	1
FOR 110 Introduction to Forestry ¹	2	ENG 111 Comp. & Rhetoric	3
MA 121 Elements of Calculus	4	MA 114 Intro. to Finite Math with Appl.	3
Hum. Social Science Elective ²	3	WFS 202 Wood Struc. Prop. I	3
PE 100 Health & Physical Fitness	1	Hum. Social Science Elective ²	3
	15	PE 253 Orienteering ⁴	1
			17

SOPHOMORE YEAR			
Fall Semester	Credits	Spring Semester	Credits
ARE 212 Econ of Agric.	3	BO 360 Introduction to Ecology	3
CH 107 Principles of Chemistry	3	BO 365 Ecology Lab	1
CH 127 Principles of Chemistry Lab.	1	PY 212 College Physics II	4
FOR 212 Dendrology	4	SSC 200 Soil Science	4
PY 211 College Physics I	4	ST 311 Introduction to Statistics	3
Physical Education Elective	1	Physical Education Elective	1
	16		16

SUMMER CAMP ⁵		Credits
FOR 204 Silviculture		2
FOR 261 Forest Communities		2
FOR 264 Forest Pest Management		1
FOR 265 Fire Management		1
FOR 274 Mapping and Mensuration		4
		10

JUNIOR YEAR			
Fall Semester	Credits	Spring Semester	Credits
ENG 112 Composition & Reading	3	FOR 304 Silviculture	4
ENT 301 Intra. to Forest Insects	3	FOR 374 For. Meas. Model and Invent.	3
FOR 303 Forestry Tree Physiology	3	FOR 434 Mgmt. Dec. Mak. For. Wood Prod.	3
FOR 319 Forestry Economics	3	PP 318 Forestry Pathology ⁶	4
Advised Elective ⁷	2	Hum./Social Science Elective ^{2,7}	3
Hum. Social Science Elective ^{3,7}	3		17
	17		

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
FOR 353 Air Photo Int. Photogrammetry	3	FOR 406 For. Inv. Anly. and Plan	4
FOR 405 Forest Management	4	FOR 472 Renew. Res. Pol. and Mgmt.	4
Advised Elective ^a	3	Advised Elective ^b	3
Hum. Social Science Elective ^b	3	Free Electives ^c	6
Free Elective ^b	3		17
	16		
		Minimum Hours Required for Graduation	141

^aAll students entering the Forestry curriculum are required to take at least one Forestry course during each of their first three semesters and until the following four courses are passed: FOR 110, CFR 134, WPS 202, and FOR 212. Grades of D or lower not accepted in ENG 111 & 112, FOR 274, 303, 304, 319, 374, 405, and 406.

^bStudents with appropriate math skills are encouraged to take the math sequence MA 141 241 242 or MA 131 231. Credit earned for MA 111 is excess credit that cannot be applied toward the 141 credit hours required for graduation.

^cFifteen credits of humanities social science electives must come from approved list and include at least 6 credits of humanities and 3 credits of social science.

^dPE 253 Orienteering must be taken prior to Summer Camp.

^eEight credits of advised electives require approval of student's advisor.

^fNine credits of free electives chosen without restriction.

^gStudent may change sequence of electives, if desired.

^hTo be eligible for summer camp, the student must (1) have made a C or better in ENG 111, (2) have passed BS 100 and MA 114 (or MA 231 or MA 241), and (3) have no more than one D in FOR 110 and 212.

ⁱThese courses may be scheduled in senior year if necessary to schedule desired electives.

CURRICULA IN NATURAL RESOURCES

The two natural resources curricula offered by the Department of Forestry are components of the campus wide baccalaureate degree program in Natural Resources. The curricula are designed to produce natural resources professionals with a broad interdisciplinary background coupled with a specific focus in natural resources management. The Natural Resources curricula are rigorous math and science based programs with a common core of math, science, communications, and humanities and social science courses that provide a broad general education. Students in all Natural Resources curricula will begin the program in a common introductory course, NR 100, and complete the program in a common senior course, NR 400, that focuses on the tools and skills of natural resource management problem solving and decision making. Those common courses will highlight the integrated nature of a broad field and provide experience in the important professional practice of working together in interdisciplinary teams.

The curriculum in **Natural Resources Ecosystem Assessment** will produce graduates who have the knowledge and skills needed to inventory and describe the characteristics of natural ecosystems and evaluate the impacts of management practices. Ecosystem assessment or environmental impact assessment is an extremely important and somewhat specialized arena in the environmental field that requires individuals who understand ecosystem structure and processes; who can identify, measure, inventory, and describe ecosystems; and who can apply standard evaluation and classification systems such as wildlife habitat evaluation procedures and the federal wetland delineation criteria. To the strong science base of the core is added a concentration that provides advanced courses in sampling and measurement and in vegetation, soils, hydrology, and wildlife and fisheries. Many of the 400 level courses also address techniques and issues of natural resource management.

The curriculum in **Natural Resources Policy and Administration** will produce graduates who have the knowledge and skills to manage natural resources programs in a variety of settings and organizations with an emphasis on public agencies. The advanced courses of the curriculum provide a broad background in economics, policy, government, public administration, and natural resources management. An economics track begins with introductory microeconomics and culminates with environmental economics and public finance. Courses in the various levels of government and public administration provide in-depth knowledge of how public institutions work. Courses in forestry, wildlife and fisheries, and outdoor recreation provide background on issues and techniques of managing natural ecosystems for various uses. A common thread of how public policy on natural resources is influenced and developed runs through many of the courses already noted and culminates in two senior courses that focus on policy.

OPPORTUNITIES

Graduates with the kind of knowledge and expertise provided by the Natural Resources Ecosystem Assessment curriculum are needed in a variety of public agencies and private organizations that are involved in environmental regulation and management. Examples are the wetlands protection programs of the US Environmental Protection Agency and the US Army Corps of Engineers and the various environmental regulatory programs of state and local governments. Private environmental consulting firms need entry level professionals with broad skills in the field of environmental assessment. The broad natural resources background provided by this curriculum also provides a strong base for students who wish to go on to graduate school or environmental law or build additional specialties focused on specific job opportunities or career tracks.

The curriculum in Natural Resources Policy and Administration is designed to produce administrators and managers for public agencies and private organizations that are involved with management, administration, policy-making, preservation, or regulation of natural resources. Examples are the USDI National Park Service, the US Environmental Protection Agency, the US Geological Survey, state and local government agencies and not-for-profit environmental organizations. The broad background in government, economics, policy, and natural resource management also provides a strong base for students who wish to pursue a graduate program in the natural resources economics and policy arena.

NATURAL RESOURCES ECOSYSTEM ASSESSMENT CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 General Biology	4	CH 101 General Chemistry I	3
CFR 134 Computers in Natural Resources	1	CH 121 General Chemistry I Lab	1
ENG 111 Composition & Rhetoric	3	COM 146 Bus. & Prof. Comm.	3
MA 131 Analytic Geometry & Calculus A ¹	4	ENG 112 Composition & Reading	3
NR 100 Intro. to Natural Resources*	2	FOR 252 Intro. to Forest Science	3
PE 100 Health & Physical Fitness	1	MA 231 Analytic Geometry & Calculus B ¹	3
	15		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 107 Principles of Chemistry	3	MEA 101 Geology I: Physical	3
CH 127 Principles of Chemistry Lab	1	MEA 110 Geology I Laboratory	1
EC 201 Economics I	3	PS 202 State & Local Government	3
FOR 212 Dendrology	4	PY 212 College Physics II	4
PY 211 College Physics	4	SSC 200 Soil Science	4
PE 253 Orienteering ²	1		15
	16		

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARE (EC) 336 Intro. Res. Environ. Econ.	3	BO 495F Local Flora	3
BO (ZO) 360 Introduction to Ecology	3	ENG 333 Comm. for Sci. & Research	3
BO (ZO) 365 Ecology Laboratory	1	NR 300 Natural Res. Measurements*	4
ST 311 Introduction to Statistics	3	ZO 460 Aquatic Natural History Lab.	2
ZO 201 General Zoology	4	Elective ³	3
Elective ³	3		15
	17		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
FOR 353 Air Photo Interpret. Photogram.	3	FOR (FW) 404 Forest Wildlife Mgmt.	3
FOR 401 For. Hydrol. Watershed Mgmt.	4	FW (AC) 485 Nat. Resources Advocacy	3
FOR (MDS) 584 Prac. of Env. Impact Assess.	4	NR 400 Mgmt. of Natural Resources*	4
FW (ZO) 420 Fishery Science	3	SSC 452 Soil Classification	4
Elective ²	3	Elective ²	3
	17		17
		Minimum Hours for Graduation	128

Note: D grades not accepted in ENG 111 and ENG 112.

¹MA 141-241 may be taken in lieu of MA 131-231. Credit for MA 111 does not count toward graduation requirements.

²History or Literature, 6 credits; Philosophy, Religion, or Fine Arts, 3 credits; Science, Technology & Society, 3 credits

³Four semesters of PE required for graduation

⁴New courses to be implemented during fall semester, 1992. Foreign Language proficiency at the FL102 level required for graduation.

NATURAL RESOURCES POLICY AND ADMINISTRATION CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 General Biology	4	CH 101 General Chemistry I	3
CFR 134 Computers in Natural Resources	1	CH 121 General Chemistry I	1
ENG 111 Composition & Rhetoric	3	COM 146 Bus. & Prof. Communication	3
MA 131 Analytic Geometry & Calculus A ¹	4	ENG 112 Composition & Reading	3
NR 100 Introduction to Natural Resources*	2	FOR 252 Introduction to Forest Science	3
PE 100 Health & Physical Fitness	1	MA 231 Analytic Geometry & Calculus B ¹	3
	15		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 107 Principles of Chemistry	3	PS 201 Intro. to American Government	3
CH 127 Principles of Chemistry Lab	1	SSC 200 Soil Science	4
EC 201 Economics I	3	ST 311 Introduction to Statistics	3
MEA 101 Geology I: Physical	3	ZO 201 General Zoology	4
MEA 110 Geology I: Laboratory	1	PE 253 Orienteering*	1
PY 211 College Physics I	4		
	15		15

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ARE (EC) 336 Intro. Res. Environ. Economics ...	3	ARE (EC) 301 Intermediate Microeconomics ...	3
BO (ZO) 360 Introduction to Ecology	1	ENG 333 Comm. for Science & Research	3
BO (ZO) 365 Ecology Laboratory	3	NR 300 Natural Resource Measurement*	4
FOR 353 Air Photo Interpret. Photogram.	3	PS 202 State & Local Government	3
PRT 360 Outdoor Recreation Management	3	Elective ²	3
Elective ²	3		
	16		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EC 410 Public Finance	3	FW (AC) 485 Natural Resources Advocacy	3
ARE (EC) 436 Environmental Economics	3	NR 400 Management of Natural Resources*	4
FW (ZO) 353 Wildlife Management or		FOR 472 Renewable Resource Policy Mgmt.	4
FW (ZO) 420 Fishery Science	3	PRT 451 Prin. Recr. Plan. Facil. Dev.	3
PS 312 Introduction to Public Admin.	3	Elective ²	3
Elective ²	3		
	15		17
		Minimum Hours Required for Graduation	125

Note: D grades not accepted in ENG 111 and ENG 112.

¹MA 141-241 may be taken in lieu of MA 131-231. Credit for MA 111 does not count toward graduation requirements.

²History or Literature, 6 credits; Philosophy, Religion, or Fine Arts, 3 credits; Science, Technology & Society, 3 credits.

³Four semesters of PE required for graduation.

⁴New courses to be implemented during fall semester, 1992. Foreign Language proficiency at the FL102 level required for graduation.

MINOR IN FOREST MANAGEMENT

The Forest Management minor is open to all undergraduate degree students at NCSU who are interested in learning the basics of the structure and functioning of forest ecosystems and the policies and practices of forest management. The minor will be useful to students in unrelated career fields who wish to have a better understanding of the scientific and policy issues involved in the sound stewardship of the nation's forests. The minor will be useful to students in related career fields who may be responsible for management of natural resources or interacting with foresters. The minor in Forest Management requires a minimum of 18 credit hours that includes two required courses, FOR 212 Dendrology and FOR 472 Renewable Resource Policy and Management, and 11 credits of elective courses. Students who wish instruction and field experience in forestry technical skills may choose to attend Forestry Summer Camp. For additional information, contact Dr. James D. Gregory, Assistant Department Head for Undergraduate Programs. (919) 515 7567.

PARKS, RECREATION AND TOURISM MANAGEMENT

Biltmore Hall (Room 4008)

Professor P. S. Rea, Head of the Department

Professors H. A. Devine, C. D. Siderelis, M. R. Warren, J. D. Wellman; *Professors Emeriti*, T. J. Hines, W. E. Smith, R. E. Sternhoff; *Associate Professors*, S. L. Kirsch, L. D. Gustke, C. S. Love, B. E. Wilson; *Associate Professors Emeriti*, G. A. Hammon, L. L. Miller, C. C. Stott; *Adjunct Associate Professors*, H. K. Cordell; *Assistant Professors*, G. L. Brothers, R. L. Moore; *Adjunct Instructors*, J. I. Connors, W. C. Singletary, Jr., G. R. Worls; *Research Assistants*, L. W. Baggs, J. M. McManus, S. Payne; *Associate Members of the Faculty*, A. Attarian (Physical Education), C. E. Chesney (Agricultural Extension Service), L. H. Harkins (Extension Forest Resources), A. Lumpkin (Physical Education), J. D. Murray (UNC Sea Grant), C. S. Vick (Cooperative Extension Service).

The department offers an interdisciplinary program combining elements of natural resource management with a concern for human services. Standards adopted by the recreation profession make college graduation a requirement for employment. North Carolina State University has facilities, staff, curriculum, program and an established reputation for comprehensive professional education in the study of parks, recreation and tourism management. The program is nationally accredited.

OPPORTUNITIES

As increased discretionary time becomes available for large segments of the American population, opportunities for growth in the leisure service professions have increased dramatically. A recreation and park professional's goal is to influence people to use their discretionary time wisely and to improve the quality of their lives. This goal is accomplished by providing recreation programs and facilities for people in a variety of settings.

Career opportunities include employment by park and recreation departments operated by county and municipal governments; employment by state agencies such as state parks, forests, and planning and advisory groups; and the federal government with agencies such as the National Park Service, Corps of Engineers, U. S. Forest Service, and military establishments.

Other major employers include youth and family service organizations such as the YMCA, YWCA, Boys' Clubs, and Boy and Girl Scouts. Industries employ recreation directors to head employee recreation programs. Recreation professionals are employed by schools as community school coordinators. Areas with perhaps the greatest growth potential for employment are tourism agencies and commercial recreation establishments such as resorts, private clubs, theme parks, and convention and conference centers.

CURRICULUM IN PARKS, RECREATION AND TOURISM MANAGEMENT

The curriculum in Parks, Recreation and Tourism Management offers a broad general education background, basic professional and technical courses, and the opportunity to specialize in a particular field. General education courses are in biology, psychology, sociology, political science, English, mathematics, physical sciences, and economics. Specialized courses are required in statistics and the use of computers.

The curriculum is designed to prepare students for a variety of positions in a young, dynamic and challenging profession. The focus of the curriculum is on management rather than face-to-face leadership. The curriculum provides 44 hours of professional course work that includes recreation philosophy, management techniques and skills, fiscal management, supervision, facility and site planning, programming, administration, and analysis and evaluation. A computer laboratory is utilized in many courses to provide the student with the best current technology available.

In addition to the general education requirements and the core professional requirements, students can begin to attain specialized training through 18 hours of concentration courses. At the beginning of the students' junior year they choose one of the following concentrations: Tourism and Commercial Recreation, Park Management, Natural Resource Management, or Program Management (including special emphasis in sports or arts management).

Academic studies on campus are supplemented by practical laboratory experiences in the Raleigh area, out-of-state field trips and study opportunities, and a ten-week internship with a park, recreation or tourism agency. Cooperative work-study programs are available.

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BO 200 Plant Life or		COM 110 Public Speaking or	
ZO 201 Animal Life	4	COM 112 Basic Prin. of Int. Comm.	3
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
MA 105 Mathematics of Finance or		PRT 152 Intro. to Rec.	3
MA 114 Intro. to Finite Math Ap. or		Chemistry or Physics Elective	4.5
MA 121 Intro. to Calculus	3.4	Computer Elective	1.3
PE 100 Health & Phy. Fitness	1	Physical Education Elective	1
PRT 101 Rec. Res. Orient. Lab	1		
Free Elective	3		15-18
	15.16		
SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EC 201 Economics I or		PRT 216 Mang Park Rec. Fac.	3
EC 212 Economics of Ag.	3	SOC 301 Human Behavior or	
PRT 215 Maint. and Op. I	3	PSY 376 Human Growth & Dev.	3
PSY 200 Intro. to Psychology or		ST 311 Intro. to Statistics	3
SOC 202 Prin. of Soc.	3	Concentration	3
English Writing Elective	3	Fine Arts Elective	3
Humanities/Pol. Sci. Anth. Elective	3	Physical Education Elective	1
Physical Education Elective	1		16
	16		
JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PRT 350 Outdoor Rec. Mgmt.	3	PRT 359 Leadership & Sup. in Rec.	3
PRT 358 The Recreation Program	4	PRT 451 Fac & Site Planning	3
Concentration	3	Concentration	3
Concentration	3	Natural Science Elective	3.4
Environmental Ethics Elective	3	Free Elective	3
	16		15.16

SUMMER SESSION
(New Works)

PRT 475 Recreation and Park Internship		Credits	
		3	
SENIOR YEAR			
Full Semester	Credits	Spring Semester	Credits
PRT 438 Recreation for Special Pop.	3	PRT 454 Recreation & Park Finance	3
PRT 453 Admin. Pol and Proceed.	3	PRT 480 Rec. Analysis & Evaluation	3
PRT 476 Post Intern Seminar	1	Concentration	3
Concentration	3	Free Elective	6
Fine Arts Elective	3		
Free Elective	3		15
	16		
		Minimum Hours Required for Graduation	135

Of the 19 hours in concentration areas: 9 to 12 hours are required specifically for the concentration selected and 6 to 9 hours are elected from controlled areas. Students must receive a "C" or better in all English writing courses (111, 112, and writing elective)

MINOR IN PARKS, RECREATION AND TOURISM MANAGEMENT

The academic minor in Parks, Recreation and Tourism Management is offered to students interested in gaining a basic knowledge of the parks, recreation and tourism field and an understanding of the importance of leisure and recreation in American society. It is not intended to prepare students for a professional career in parks, recreation and tourism. Seven hours of required courses and nine hours of electives are necessary to complete the minor. The program provides a background in recreation and park management which is useful to students who will 1) assume full time careers that are associated with recreation and park services, and 2) become involved in the park and recreation field as a volunteer, program leader or policy making board member with such organizations as the Scouts, Y's, art advisory councils, and conservation organizations.

WOOD AND PAPER SCIENCE

Biltmore Hall (Room 2105)

Professor R. J. Thomas, Head of the Department

Alumni Distinguished Undergraduate Professor: M. W. Kelly

Alumni Distinguished Graduate Professor and Elis & Signe Olsson Professor: J. S. Gratzl

Reuben B. Robertson Professor: H-M Chang

Professors: H-M Chang, E. L. Deal, J. S. Gratzl, C. A. Hart, T. W. Joyce, M. W. Kelly, H. G. Olf, E. A. Wheeler; *Professors Emeriti:* A. C. Barefoot, E. L. Ellwood, I. S. Goldstein, R. G. Hitchings, R. G. Pearson; *Adjunct Professors:* L. L. Edwards, T. K. Kirk, S. Y. Lin, T. O. Norris, R. P. Singh; *Associate Professors:* J. Deng, S. J. Hanover, J. A. Heitmann, Jr., L. G. Jahn, H. Jameel, J. S. Stewart; *Adjunct Associate Professor:* R. B. Phillips; *Associate Professors Emeriti:* R. C. Gilmore, L. H. Hobbs, C. G. Landes, C. N. Rogers; *Assistant Professor:* B. Kasal; *Adjunct Assistant Professors:* A. G. Raymond, Jr., H. A. Stewart; *Instructor:* A. G. Kirkman; *Research Associates:* C. L. Chen, E. Jerger, N. C. Weidhaas; *Research Assistants:* W. S. Bryant, M. V. Byrd; *Associate Member of the Faculty:* R. D. Gilbert.

The wood-based industry of North Carolina, as well as throughout the South, is a vital part of the nation's economy. In terms of the dollar value of shipments of wood products, the South leads all regions of the country. North Carolina manufactures more wood household furniture than any other state, ranks third in shipment value for all wood-based products and second in number of employees and wages paid. Thus, many opportunities exist in North Carolina and other southern states for careers in the wood-based industry.

The Department of Wood and Paper Science offers two curricula leading to Bachelor of Science degrees--(1) Pulp and Paper Science and Technology, and (2) Wood Products. Both

curricula prepare young men and women for careers in the wood-based and allied industries or in government agencies connected with wood resources.

PULP AND PAPER SCIENCE AND TECHNOLOGY

A. G. Kirkman, *In Charge*

The Pulp and Paper Science and Technology curriculum prepares students for careers in pulp and paper, an industry that ranks as the fifth largest manufacturing industry in the United States. Science, engineering, and mathematics form the basis for a multidisciplinary approach to understanding the fundamental manufacturing principles involved. Students study wood pulping processes, chemical and by product recovery systems, and pulp bleaching. In addition, various paper making operations such as refining, sizing, coating, and drying are studied.

Two concentrations are available emphasizing the technological or engineering aspects of pulping and papermaking. The Technology Concentration provides an extensive background in the pulp and paper manufacturing processes and elective credit hours for studies in marketing, economics, management or other concentrations of interest to the student. Greater depth in the engineering principles underlying pulp and paper manufacturing can be obtained from the Chemical Engineering Concentration. Students who have completed the Chemical Engineering Concentration in pulp and paper science and technology can, in cooperation with the College of Engineering and with an additional semester of study, earn a Bachelor of Science in Chemical Engineering as a second degree.

OPPORTUNITIES

Graduates of this curriculum find opportunities for challenging careers as process engineers, product development engineers, process control chemists, technical service engineers, quality control supervisors, and production supervisors. Design and construction engineering companies employ graduates as project engineers, and pulp and paper machinery companies use their education and skills for technical service and sales positions. Opportunities for managerial and executive positions are available to graduates as they gain experience.

SUMMER INTERNSHIP

All pulp and paper majors are required to work one summer in a pulp or paper mill. One hour of academic credit is granted after completion of 12 weeks of mill work and presentation of a satisfactory report. In addition, students are urged to work in mills the other two summers, as the work provides valuable practical experience. Departmental advisors assist students in locating summer work.

REGIONAL PROGRAM

The pulp and paper curriculum is a regional program approved by the Southern Regional Education Board as the undergraduate program to serve the Southeast in this field.

SCHOLARSHIPS

Approximately 85 undergraduate academic scholarships are granted annually to new and continuing students by more than 100 companies comprising the Pulp and Paper Foundation.

PULP AND PAPER SCIENCE AND TECHNOLOGY CURRICULUM

TECHNOLOGY CONCENTRATION

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	4	CH 107 Principles of Chemistry	4
E 115 Intro. to Comput. Environments	1	ENG 112 Composition and Reading	3
EC 201 Economics I	3	MA 241 Analytical Geometry & Calc. II	4
ENG 111 Composition and Rhetoric	3	PY 205 Physics for Engineers & Sci. I	4
MA 141 Analytical Geometry & Calc. I	4	WPS 102 Intro. Pulp and Paper Technology	1
WPS 101 Intro. Wood and Paper Science	1	Physical Education Elective	1
PE 100 Health and Physical Fitness	1		
	<u>17</u>		<u>17</u>

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CHE 205 Chemical Process Principles	4	CH 221 Organic Chemistry I	4
CSC 112 Intro. Computing—Fortran	3	PY 208 Physics for Engineers & Sci. II	4
MA 242 Analytical Geometry & Calc. III	4	ST 361 Intro. to Statistics for Engrs.	3
WPS 215 Pulping Technology	3	WPS 216 Papermaking Technology	3
Physical Education Elective	1	Humanities/Soc. Sci. Elective*	3
	<u>16</u>		<u>17</u>

SUMMER SESSION

	<i>Credits</i>
WPS 211 Pulp and Paper Internship	1

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 223 Organic Chemistry II	4	ENG 331 Communication for Engr. and Tech. ...	3
CH 331 Intro. Physical Chemistry	4	WPS 332 Wood and Pulping Chemistry	4
WPS 310 Paper Properties and Additives	3	WPS 360 Pulp and Paper Unit Processes II	3
WPS 355 Pulp and Paper Unit Processes I	3	Humanities/Soc. Sci. Elective*	3
Humanities/Soc. Sci. Elective*	3	Free Elective	3
	<u>17</u>	Physical Education Elective	1
			<u>17</u>

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
WPS 471 Pulping Process Analysis	3	WPS 403 Paper Process Analysis	3
WPS 410 Mod. & Sim. Pulp & Paper Processes ...	3	WPS 460 Environmental Issues	2
WPS 475 Process Control	3	WPS 416 Project Management II	3
WPS 415 Project Management I	2	Humanities/Soc. Sci. Elective*	3
Humanities Soc. Sci. Elective*	3	Free Elective	3
Free Elective	3		
	<u>17</u>		<u>14</u>

Minimum Hours Required for Graduation 132

*See approved list: 6 hours must be taken from Humanities and 6 hours must be taken from Social Science and remaining 6 hours may be taken from either Humanities or Social Science.

PULP AND PAPER SCIENCE AND TECHNOLOGY CURRICULUM

CHEMICAL ENGINEERING CONCENTRATION

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	4	CH 107 Principles of Chemistry	4
E 115 Intro. to Comput. Environments	1	ENG 112 Composition and Reading	3
EC 201 Economic I	3	MA 241 Analytical Geometry & Calc. II	4
ENG 111 Composition and Rhetoric	3	PY 205 Physics for Engineers & Sci. I	4
MA 141 Analytical Geometry and Calc. I	4	WPS 102 Intro. Pulp and Paper Technology	1
WPS 101 Intro. Wood and Paper Science	1	Physical Education Elective	1
PE 100 Health and Physical Fitness	1		
	17		17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CHE 205 Chemical Process Principles	4	CH 221 Organic Chemistry I	4
CSC 112 Intro. Computing Fortran	3	MA 341 Appl. Differential Equations I	3
MA 242 Analytical Geometry & Calc. III	4	PY 208 Physics for Engineers & Sci. II	4
WPS 215 Pulping Technology	3	WPS 216 Papermaking Teachers	3
Physical Education Elective	1	Free Elective (CHE 225)**	3
	15		17

SUMMER SESSION

	<i>Credits</i>
WPS 211 Pulp and Paper Internship	1

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 223 Organic Chemistry II	4	CH 437 Physical Chemistry for Engrs.	4
CHE 311 Transport Processes I	3	WPS 332 Wood and Pulping Chemistry	4
CHE 315 Thermodynamics I	3	WPS 360 Pulp and Paper Unit Processes II	3
WPS 310 Paper Properties and Additives	3	Free Elective (CHE 312)**	3
Humanities Soc. Sci. Elective*	3	Free Elective (CHE 316)**	3
Physical Education Elective	1		
	17		17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
WPS 471 Pulping Process Analysis	3	WPS 403 Paper Process Analysis	3
WPS 410 Mod. & Sim. Pulp & Paper Processes ..	3	WPS 460 Environmental Issues	2
WPS 475 Process Control	3	WPS 416 Project Management II	3
WPS 415 Project Management I	2	Humanities Soc. Sci. Electives*	6
Humanities Soc. Sci. Electives*	6		
	17		14

Minimum Hours Required for Graduation . . . 132

* See approved list: 6 hours must be taken from Humanities and 6 hours must be taken from Social Science and remaining 6 hours may be taken from either Humanities or Social Science.

**To complete requirements for a BS in PPT and CHE in nine semesters, indicated CHE course must be used as a free elective.

Additional Courses for CHE Degree: CHE 330, CHE 446, CHE 450, ECE 331 MAT 201.

MINOR IN PULP AND PAPER SCIENCE AND TECHNOLOGY

The Pulp and Paper Technology minor is available to all undergraduate students enrolled in the University as degree candidates, except Pulp and Paper Technology majors. The minor requires 15 credit hours. Six hours of required courses provide a comprehensive overview of pulping and papermaking science and technology, including pulping, bleaching, chemical recovery, recycled fibers, stock preparation, papermaking, coating, printing, converting, and environmental aspects. Nine elective hours may be chosen from areas

including paper properties, wood chemistry, unit operations, computer modeling and simulation of processes, project management, environmental issues, or process control. This course will provide more in depth exposure to the basic pulping, bleaching and papermaking processes.

The Pulp and Paper Technology minor, with its focus on papermaking science and technology, is intended to be especially valuable to students majoring in programs leading to careers in corporate or government positions which would interface with the paper and related industries. Students interested in business, scientific or engineering specialties which may interface with or be employed by these industries will find the minor especially useful.

The office location and phone number for students and others inquiring about the PPT minor is: Department of Wood and Paper Science, 2105 Biltmore Hall, (919) 515 5807.

WOOD PRODUCTS

Professor M. W. Kelly, In Charge

The wood products industry is of major importance to the economy of North Carolina and the Southeast. It ranks third in the state in the value of shipments, behind only textiles and tobacco products, and it is second to textiles in the number of employees. The managerial opportunities for graduates with a B.S. in Wood Products are excellent. Graduates of this program have a broad education in the humanities, communication skills, social and natural sciences, as well as the professional training required for managerial positions in the wood products industry. The curriculum, similar to a material science program, is based on the natural resource wood with an emphasis on industrial manufacturing and management. Graduates' knowledge of wood as a raw material enable them to properly design and process a variety of wood-based products of value to society. As the availability of nonrenewable resources decreases and their costs increase, the demand for wood, a renewable resource, increases. Currently, career opportunities are excellent and continued demand for individuals with a wood products education is anticipated.

OPPORTUNITIES

The Wood Products curriculum at North Carolina State University, which is accredited by the Society of Wood Science and Technology, prepares graduates for production supervision, staff positions and management responsibilities in all types and sizes of wood industries. Careers also include positions with both large and small companies manufacturing consumer wood products such as furniture. Graduates are also in demand by suppliers to wood manufacturing industries such as chemical and machinery companies.

SCHOLARSHIPS

Approximately six undergraduate merit scholarships are granted annually to new and continuing students through the Forestry Foundation.

TECHNICAL ELECTIVES

The curriculum provides a minimum of 15 credit hours for technical electives which may be used to pursue a minor in a variety of areas including business management, industrial engineering, forestry management or economics. For those undergraduates desiring exposure to more than one area, the technical electives may be chosen from these areas and from others, e.g., furniture manufacturing and management and graphic communication.

DUAL DEGREE PROGRAMS

Dual degree programs are available whereby students can obtain, in addition to a Bachelor of Science in wood products, a second Bachelor of Science degree in forestry, pulp and paper science, business management or in other areas. Credits beyond those required

for the single degree program are necessary and a minimum of an additional year of study is usually required. Individuals interested in a dual degree should contact the appropriate departmental office.

WOOD PRODUCTS CURRICULUM

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BD 200 Plant Life or		CH 101 General Chemistry I	3
BS 100 General Biology	4	CH 121 General Chemistry I Lab	1
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 131 Anly. Geom. & Calc. A ¹	4	GC 101 Engineering Graphics I	2
WPS 101 Intro. to WPS	1	MA 231 Anly. Geom. & Calc. B ¹	3
PE 100 Health and Physical Fitness	1	WPS 202 Wood Struc. and Prop. I	3
Humanities Soc. Sci. Elective ²	3	Physical Education Elective	1
	16		16

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CFR 134 Computers in Forest Res.	1	EB 201 Economics I (Soc. Sci.)	3
CH 107 General Chemistry II	3	PY 212 General Physics II	4
CH 127 General Chemistry II Lab	1	WPS 203 Wood Struct. and Prop. II	4
PY 211 General Physics I	4	Humanities/Soc. Sci. Elective	3
WPS 240 Wood Products	3	Free Elective	3
Humanities Soc. Sci. Elective	3		17
Physical Education Elective	1		
	16		

SUMMER PRACTICUM *Credits*

WPS 205 Wood Products Practicum	5
WPS 210 Forest Products Internship	1
	6

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 331 Comm. Tech. Info.	3	WPS 302 Wood Processing II	4
ST 361 Statistics for Engineers	3	WPS 316 Wood Polymer Principles	4
WPS 301 Wood Processing I	4	WPS 344 Intro. To Quality Control	3
Humanities Soc. Sci. Elective ²	3	WPS 350 Wood Technology Literature	2
Technical Elective	3	Technical Elective	3
Physical Education Elective	1		16
	17		

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
WPS 441 Intro. to Wood Mechanics	4	WPS 434 Quan. Meth. of Dec Mak. in Forest Products	3
WPS 482 Senior Topics in WPS	2	WPS 444 Wood Composites	3
Humanities Soc. Sci. Elective ²	3	WPS 450 Wood Ind. Case Studies	2
Technical Elective	3	Technical Electives	6
Free Elective	3	Free Elective	3
	15		17

Minimum Hours Required for Graduation . . . 136

¹Students with appropriate mathematical aptitude and interest are encouraged to substitute MA 141, MA 241, and MA 242 for the mathematical sequence listed.

²See approved list; 6 hours must be taken from Humanities and 3 hours must be taken from Social Science and remaining 6 hours may be taken from either Humanities and or Social Science.

MINOR IN WOOD PRODUCTS

The Wood Products minor is available to all undergraduate students, except Wood Products majors, enrolled in the University as degree candidates. The minor requires 15 credit hours. Ten hours of required courses provide a general background in wood anatomy, physical properties, and wood-based composites. Five elective hours may be chosen from areas including wood processing, wood mechanics, quality control, and wood-polymer interactions.

The Wood Products minor, with its focus on wood properties and processing, is designed to be especially valuable to students majoring in programs leading to careers in areas such as structural design, furniture manufacturing, and forestry. Students interested in natural and renewable materials will also find the minor useful.



COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

Caldwell Hall (Room 106)

W. B. Toole, III, *Dean*

M. M. Sawhney, *Associate Dean*

G. D. Garson, *Associate Dean for Planning and Management*

W. C. Fitzgerald, *Interim Associate Dean for Research and Graduate Programs*

M. L. Walek, *Assistant Dear. for Undergraduate Affairs*

S. E. Simonsen, *Assistant to the Dean for International Studies*

J. N. Wall, *Director of Honors Scholars Programs*

D. B. Greene, *Coordinator of Arts Studies*

L. H. Hamburger, *Coordinator of Evening Programs and Assistant to the Dean*

J. S. Griffin, *Academic Coordinator for African American Students*

The College of Humanities and Social Sciences offers programs of study which lead to baccalaureate and advanced degrees in the disciplines comprising the humanities and social sciences and also offers courses in these areas which are part of the programs of all undergraduate students in the university. In this way the university provides an opportunity for its students to prepare for a full life in professions and occupations that require intellectual flexibility, broad knowledge, and a basic comprehension of human beings and their problems.

Eight departments are included in the College of Humanities and Social Sciences: Communication, English, Foreign Languages and Literatures, History, Philosophy and Religion, Physical Education, Political Science and Public Administration, and Sociology and Anthropology (also a department in the College of Agriculture and Life Sciences). The Division of Multidisciplinary Studies, an academic unit responsible for interdisciplinary programs, is also affiliated with this college. Undergraduate majors are offered in communication, English, history, French, Spanish, philosophy, political science, sociology, social work, and multidisciplinary studies. In some departments special concentrations are available within the major programs: e.g., communication disorders, mass communication, public relations and theatre (communication), writing and editing (English), law and political philosophy (political science or philosophy), anthropology (sociology), religious studies (philosophy), and criminal justice (political science or sociology). A teacher education option is available in English, French, Spanish, and social studies (history, political science, sociology). Enrollments in teacher education programs may be limited. Degrees granted include the Bachelor of Arts, the Bachelor of Science, the Bachelor of Social Work, the Master of Arts, and the Doctor of Philosophy, as well as professional degrees in political science and sociology.

BACHELOR OF ARTS PROGRAM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
Foreign Language 201 (Intermediate) [†]	3	History	3
History [‡]	3	Mathematics	3-4
Mathematics [‡]	3-4	Philosophy [‡]	3
Social Science Elective [‡]	3	Social Science Elective	3
PE 100 Health & Physical Fitness	1	Physical Elective	1
	<hr/>		<hr/>
	16-17		16-17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Literature [§]	3	Arts and Letters Elective [§]	3
Natural Science [¶]	3-4	Literature	3
Social Science	3	Natural Science	3-4
Electives	6	Social Science	3
Physical Education Elective	1	Elective	3
	<hr/>	Physical Education Elective	1
	16-17		<hr/>
			16-17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Major [¶]	9	Major	9
Electives	6	Electives	6
	<hr/>		<hr/>
	15		15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Major	9	Major	6
Electives	6	Electives	9
	<hr/>		<hr/>
	15		15

Minimum Hours Required for Graduation 124

[†]This two semester requirement includes a course concerned with pre-industrial Western or non-Western societies (HI 207, 208, 209, 215, 216, 263, 264, 275, or 276), and another dealing with the United States or post industrial Western societies (HI 205, 210, 221, 222, 233, 251, or 252).

[‡]Two semesters are required for sociology majors (MA 111 and 131 recommended but any two mathematics courses other than MA 101 allowed). For all other humanities and social science majors the requirement may be satisfied with any two mathematics courses other than MA 101 or one mathematics course other than MA 101 plus a course in computer science, statistics, or logic.

[§]Three hours of philosophy, exclusive of logic (PHI 201 and 335), are required.

[¶]Demonstrated proficiency at the first-semester intermediate level (FL 201) in French, Spanish, German, Russian, Portuguese, Italian, Latin, Classical Greek, Biblical Hebrew, Japanese, Chinese, or Swahili. In order to enroll at the 201 level, prerequisites must be met through course work or the Placement Test. Demonstrated proficiency at the second-semester intermediate level (FL 202) in one language is required for English and foreign language majors.

[¶]The requirements call for twelve hours of social science representing at least three of the following disciplines: anthropology, economics, political science, psychology, sociology. At least nine of these hours must be outside the student's major field.

[¶]This requirement consists of two literature courses, at least one of which must be in literature outside the United States and prior to the twentieth century. One of the courses must come from the following: ENG/FL 221, ENG/FL 222, ENG 251*, ENG 261*, ENG 262*, FL 301, FLS 301, FLG 316, or FLR 303. The second course may also come from the list above or it may be a course in American or twentieth century literature (either ENG/FL 223, ENG/FL 224, ENG 246, ENG 248, ENG 252, ENG 265, ENG 266, or FLR 304), or it may be an upper-division survey course or literature course in a period, genre or major in English, a foreign language in English translation, or the original foreign language (either ENG 305, 349, 351, 362, 363, 369, 371, 372, 376, 377, 380, 382, 383, 385, 390, 398, 399, 439, 448, 449, 451, 453, 462, 463, 468, 469, 486, 487; FL 302, 316, 323, 324, 352, 414, 415, 492; FLG 323; FLS 302, 304, 323, 403, 404, 492; or GRK 320).

*Students using ENG 261 or ENG 262 to satisfy this requirement may not also use ENG 251.

[¶]The natural science requirement calls for a minimum of eight hours. At least one course must include a laboratory experience. Students must receive credit for at least one basic introductory course from physics, chemistry, geology, or the biological sciences. These courses include CH 100, CH 101/121, CH 107/127, PY 205, PY 208, PY 211, PY 212, PY 222, 225, and PY 231; MEA 101/110; BS 105; BO 200. To complete the requirement, students may take any of the courses listed above, except that if BS 100 or BS 105 has been taken the other may not be taken for credit and that BO 200 may not be combined with either BS 100 or BS 105; and CH 100 may not be taken for credit if the student has previously received

credit for CH 101. Otherwise the requirement may be completed with any course in botany, chemistry, genetics, physics, zoology, or marine, earth, and atmospheric sciences (except MEA 120, 208, or 215), or with ENT 425.

*One of the following three hour courses outside the student's major is required: music, history of art, or dance (including the DAN 272 295 sequence and MDS 351) or a course in film (ENG 282, ENG 492, COM 364, COM 374, MDS 496) or theatre (COM 103, COM 203, COM 213, COM 233, COM 243, COM 303, COM 313, COM 323, COM 333) or in religion (any REL course other than a Hebrew language course), rhetoric (COM 321, COM 411) or classics (GRK[LAT]310) will fulfill this requirement. (Note: LTN students may use ENG FL 221 or ENG 390 to fulfill this requirement.)

*Major requirements for the Bachelor of Arts range from 30 to 42 hours.

BACHELOR OF SCIENCE PROGRAM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 121 General Chemistry I	4	CH 107 127 Principles of Chemistry	4
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
Humanities Social Science Elective ¹	3	Humanities Social Science Elective	3
Mathematics ²	4	Mathematics	3-4
PE 100 Health & Physical Fitness	1	Physical Education Elective	1
	15		14 15

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PY 206 or 211 General Physics I	4	PY 208 or 212 General Physics II	4
Course I Major ³	3	Course II Major	3
English Literature Foreign Language ⁴	3	English Literature Foreign Language	3
Mathematics	3-4	Humanities Social Science Elective	3
Philosophy ⁵	3	Mathematics	3
Physical Education Elective	1	Physical Education Elective	1
	17-18		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 General Biology	4	BO 200 Plant Life or	
Course I Option ⁶	3	ZO 201 General Zoology	4
Course III-Major	3	Course II Option	3
History or Philosophy of Science ⁷	3	Course IV Major	3
Humanities Social Science Elective	3	Course V Major	3
	16	Elective	3
			16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Course III Option	3	Course V Option	3
Course IV Option	3	Course VIII Major	3
Course VI-Major	3	Course IX-Major	3
Course VII Major	3	Electives	6-8
Elective	3		15 17
	15		

Minimum Hours Required for Graduation 127

¹Twelve hours in humanities and/or social sciences outside the major discipline are required.

²Four courses are required, including either the sequence MA 141 241 242 or MA 131, 231. The remaining course(s) are to be chosen from MA 114, 214 303, 341, and 405.

³A total of 27 credit hours are required in the major field.

⁴Six hours of foreign language and/or English literature at the 200 level or above are required.

⁵Any course in philosophy, excluding logic (PHI 201, 335) and philosophy of science (PHI 340).

⁶A 15 hour concentration is required in a mathematics, science, or engineering discipline.

⁷A course in the history or philosophy of sciences or mathematics to be chosen from a specified list of alternatives.

MINOR IN INTERNATIONAL STUDIES

An International Studies minor is offered to all students in the University who want to add a significant international dimension to their departmental majors. This minor program enables students to explore international topics, issues and research from cross-cultural, transnational perspectives. The program will provide some tools that students can use to understand better the global context of the modern world and to learn the international dimensions of their chosen fields of study.

MINOR IN ARTS STUDIES

The College of Humanities and Social Sciences offers an academic minor in Arts Studies to all majors in the university. This interdisciplinary minor is designed to enrich the student's university experience, to serve as a foundation for learning and understanding in the arts beyond the university years, and to stimulate intellectual development in ways that may reinforce or complement the objectives of the student's major. This minor provides the student with a fundamental understanding of the historical, theoretical, and practical disciplines of the arts. A total of eighteen credit hours must be taken to complete this minor. Students interested in the minor should refer to the Arts Studies courses listed under "Arts Studies" in the course description section of this catalog. These courses are described in detail under their departmental prefixes.

HONORS PROGRAMS

In conjunction with the Division of Student Affairs, the College of Humanities and Social Sciences sponsors the Scholars of the College Program for students who show exceptional academic promise. The participants in this residential program take special sections of freshman and sophomore level courses and participate in a series of cultural events and weekly forums. In their junior year they participate each semester in a special Junior Scholars Seminar and attend monthly forums. For upper level students, each degree-granting department in the college offers an honors program designed to encourage outstanding students to develop their intellectual potential to the fullest extent possible through individualized study, special seminars, and close association with faculty members in their major field.

SCHOLARSHIPS

In addition to the University-wide awards available, the following scholarships are offered to entering freshmen:

- J. Carlie Adams, Sr. Endowed Scholarship (\$500)
- Claire Simmons Allan Sampson Memorial Scholarship in Moral Philosophy (\$1000)
- Bess B. and Lynton Yates Ballentine Scholarship (\$1000)
- Frances W. and Gerald O. T. Erdahl Memorial Scholarship (\$1000)
- Mary M. Penney Scholarship in English (\$1000)

For further information, write:

Dr. John Wall
Director, Honors/Scholars Program
College of Humanities and Social Sciences
North Carolina State University
Box 8105
Raleigh, NC 27695-8105

PRE-LAW PROGRAM

Law schools neither prescribe nor recommend a particular undergraduate curriculum for prospective candidates. The Association of American Law Schools has, however, recommended an undergraduate education of the broadest possible scope as the best means of developing the communicative, critical, and creative skills and abilities fundamental to success in legal studies and practice. A student may prepare for post-graduate work in law in any of the majors offered by the eight degree-granting departments in the College of

Humanities and Social Sciences. Alternatively, the student may elect the Concentration in Philosophy of Law (Department of Philosophy and Religion) or the Concentration in Law and Political Philosophy (Department of Political Science and Public Administration) or may apply for admission to the Multidisciplinary Studies program during the sophomore year and, in consultation with an adviser, design a pre law major involving two or more academic areas.

All interested entering freshmen are invited to attend a special orientation session for pre-law students. These students are also invited to join the Pre-law Student Association, an undergraduate organization that provides pre-law students with information concerning preparation for the Law School Admission Test (LSAT) as well as the study and practice of law through guest speakers, discussion sessions, and other activities. Consult Prof. Baumer, (919) 515-6950, or Prof. Levenbook, (919) 515-3214, for more information.

COOPERATIVE EDUCATION

Cooperative Education in humanities and social sciences seeks to broaden the student's intellectual horizons and at the same time to provide an introduction to the world of business, industry, government, or finance in preparation for a career after graduation. In this program the freshman and senior years are usually spent on campus while the sophomore and junior years are devoted either to alternate periods of on-campus study and off campus work or to a parallel arrangement of part time work and part time study on a continuous basis. The student is paid for work experiences by the employer. Ordinarily the program takes five years to complete, but those who are willing to attend summer school or take on a summer co-op assignment can finish in four years. Transfer students are eligible, and all interested students are urged to apply early in the academic year. The program is also open to graduate students although less time is required on work assignment.

Further information may be obtained from T. N. Wall, Coordinator of Cooperative Education, 213 Peele Hall, (919) 515 2300.

JEFFERSON SCHOLARS IN AGRICULTURE AND THE HUMANITIES

The Thomas Jefferson Scholars Program in Agriculture Life Sciences and the Humanities is a joint program of the College of Agriculture and Life Sciences and the College of Humanities and Social Sciences. It is a double degree which permits participants to have two concentrations: one in an area of agriculture/life sciences and one in an area of humanities/social sciences. The double degree program may be individually designed to meet each student's particular interests and career goals. The purpose of the program is to produce potential leaders in agriculture and the life sciences who have not only technical expertise but also an appreciation for the social, political, and cultural issues that affect decision making.

Each spring a number of entering freshmen are chosen to receive scholarships to participate in the Jefferson program. In addition, other qualified students may choose to pursue a double major in agriculture/life sciences and the humanities under the Jefferson program. Students interested in applying to the Jefferson Scholars program should contact: Dr. James Oblinger, Associate Dean, College of Agriculture and Life Sciences, Box 7642, North Carolina State University, Raleigh, NC 27695, (919) 515-2615 or Dr. Mary L. Walek, Assistant Dean, College of Humanities and Social Sciences, Box 8101, North Carolina State University, Raleigh, NC 27695, (919) 515 2467, before January 15.

BENJAMIN FRANKLIN SCHOLARS PROGRAM

A limited number of freshmen in the College of Engineering are selected to participate in the Benjamin Franklin Scholars program. In addition to their major courses, each Benjamin Franklin Scholar develops an individualized, five-year plan of work focused on a central theme in the humanities and social sciences. Students completing the program receive a bachelor of science in an engineering discipline or computer science and a bachelor's degree in multidisciplinary studies.

This double-degree program, a joint undertaking of the College of Engineering and the College of Humanities and Social Sciences, provides a unique opportunity to integrate a

solid base of knowledge in technology or science with the broad philosophical perspective of the humanities. The curriculum for the double-degree program has four main components: (1) a strong general education, (2) specially designed interdisciplinary and problem defining courses, (3) all technical course requirements associated with the engineering or computer science degree, and (4) a 30 hour multidisciplinary concentration designed by the student in consultation with his or her advisers. With careful planning, this program can be completed in five years.

For more information, contact the Assistant Dean for Academic Affairs, College of Engineering (118 Page Hall) or the Assistant Dean for Undergraduate Affairs, College of Humanities and Social Sciences (106 Caldwell Hall).

ELI WHITNEY DOUBLE DEGREE PROGRAM IN TEXTILES AND INTERNATIONAL STUDIES

This joint program between the College of Textiles and the College of Humanities and Social Sciences allows a student to earn a B.S. in Textile and Apparel Management and a B.A. in Multidisciplinary Studies with a concentration in international studies. This dual degree is designed to prepare students for work in the increasingly international textile industry. The program includes all the technical course requirements associated with the textile and apparel management degree. For the B.A. in Multidisciplinary Studies, students choose from among three areas of concentration: the Pacific Rim (language study in Japanese or Chinese), Latin America (language study in Spanish), or Europe (language study in German or Italian). The program, which takes four to five years to complete, also includes possible overseas internships.

Merit scholarship awards are available for high achieving students who participate in the double degree program in textiles and international studies. For more information, contact Dr. Gordon Berkstresser, Textile Management and Technology (3404 Textile Building) (919) 515 6593 or the Assistant Dean for Undergraduate Affairs, College of Humanities and Social Sciences (106 Caldwell Hall) (919) 515-2467.

FOLGER INSTITUTE

North Carolina State University is a member of the Folger Institute of Renaissance and Eighteenth-Century Studies, a unique collaborative enterprise sponsored by the Folger Shakespeare Library in Washington, D.C., and twenty universities in the Middle Atlantic region. Each year the institute offers an interdisciplinary program in the humanities seminars, workshops, symposia, colloquia, and lectures. Admission is open to faculty and students of North Carolina State University, and a limited number of fellowships are available through the campus Folger Institute Committee.

COMMUNICATION

Winston Hall (Room 201)

Professor W. J. Jordan, Head of the Department

Assistant Professor E. T. Funkhouser, Assistant Head of the Department and Coordinator of Advising

Professors: W. G. Franklin, W. J. Jordan, L. W. Long, R. L. Schrag; Professor Emeritus C. A. Parker; Associate Professors: R. D. Anderson, L. R. Camp, P. C. Caple, D. A. Deloy, R. Leonard, H. E. Munn, Jr., B. L. Russell; Assistant Professors: E. T. Funkhouser, V. Gallagher, D. Ivy, M. Javidi, N. H. Snow; Lecturers: J. Alchediak, C. A. Eileman, T. J. Kauffman, M. Pandich; Teaching Technician: M. Velasquez.

The Bachelor of Arts in Communication program provides study and training in human communication for professionals entering business, industry, social welfare organizations or government service. Today, many organizations are seeking graduates with demonstrated competencies in human communication to fill positions which require constant and skillful contact with a wide variety of internal and external publics. Depending upon their

area of specialization, graduates may find employment opportunities as communication consultants, media specialists, trainers, public relations specialists, therapists, or performers. Many graduates choose to enter graduate or law schools.

PROGRAM OF STUDY

The Communication major calls for successful completion of at least 36 semester credit hours of communication (COM) courses. Three of these courses, COM 110, COM 112, and COM 190, totaling nine semester credit hours, are completed by all students majoring in communication. The remaining credit hours in the major come from courses completed in one or more of the following concentrations offered by the Department of Communication:

Communication: A generalist approach to the study of communication, this concentration allows students a high degree of flexibility in course choice. Many of the elective courses in this concentration are related to the study of rhetoric and public address.

Communication Disorders: The undergraduate portion of preparation for speech language therapist or audiologist careers. A master's degree is required for entry into these professions.

Mass Communication: A broad curriculum in the structure, operation, and social effects of the mass media in the United States with emphasis on electronic media, including courses in broadcast and non broadcast media writing and production, media criticism, and media history.

Public Relations: Instruction in the communication theories and methods applied by organizations to establish and maintain mutually beneficial relationships with employees, governments, stockholders, and other publics.

Theatre: Studies in stage directing, acting, scenic and lighting design, and stagecraft. African-American dramaturgy and children's touring theatre are special features of this program. Courses are taught at Thompson Theatre on the NCSU campus.

CURRICULUM NOTES

- Students must enroll in COM 190 during their first semester as a communication major.
- Transferring to communication from another NCSU major requires a minimum GPA of 2.0 with at least 15 credit hours completed. Such transfers are not permitted during the first week of classes or during the registration advising period each semester.
- No final grades below C are permitted for courses used in the communication major.
- To qualify for graduation, each student must have a minimum GPA of 2.0 for all courses completed at NCSU, and at least a 2.0 GPA for all courses taken in the communication major.
- COM 146, Business and Professional Communication, is intended for students in majors other than communication. Students majoring in communication may not use this course to satisfy any requirement within the 36-credit-hour major.

MINORS

A minor in Theatre is offered. Also, the Communication Department and the Department of English and the Division of Multidisciplinary Studies jointly offer a Film Studies minor. Literature detailing the requirements for these minors is available at the main department office. Those interested in the Journalism minor at NCSU should contact the English Department.

INTERNSHIPS

The department operates an internship program which offers qualified seniors the opportunity to gain work experience in the communication field. The internship is required of all students in the public relations concentration, but students from the other communication concentrations may also participate in this program. For additional information, contact Dr. Ruth Anderson, director of the internship program, at the phone number and address shown below.

FURTHER INFORMATION

Those who are interested in studying communication at NCSU are encouraged to contact the department for additional information. An appointment with the communication department's Coordinator of Advising is recommended. To reach the communication department, you may call (919) 515 2450 or write to Box 8104, NCSU, 27695 8104.

ENGLISH

Tompkins Hall (Rooms 131, 246)

Professor J. E. Bassett, Head of the Department

Associate Professor C. A. Prioli, Associate Head of the Department

Associate Professor D. H. Covington, Assistant Head for Scheduling

Senior Lecturer P. R. Cockshutt, Coordinator of Advising

Professor W. E. Meyers, Director of Freshman Program

William C. Friday Distinguished Professor: W. Wolfram

Alumni Distinguished Undergraduate Professors: L. S. Champion, M. T. Hester

*Professors: B. J. Baines, G. W. Barrax, J. E. Bassett, L. S. Champion, J. D. Durant, J. A. Gomez, J. M. Greenwood, A. H. Harrison, M. T. Hester, L. T. Holley, K. F. Holloway, L. H. Mackethan, W. E. Meyers, C. R. Miller, M. S. Reynolds, L. S. Rudner, L. Smith, J. J. Smoot, A. F. Stein, W. B. Toole, III, J. N. Wall, M. C. Williams, W. Wolfram, R. V. Young, Jr., *Adjunct Professor: D. D. Short; Professors Emeriti: P. E. Blank, Jr., M. Halpern, H. G. Kincheloe, A. S. Knowles, B. G. Koone, F. H. Moore, P. Williams, Jr.; Associate Professors: L. J. Betts, Jr., M. P. Carter, E. D. Clark, J. W. Clark, D. H. Covington, J. Ferster, J. J. Kessel, M. F. King, D. L. Laryea, C. Nwankwo, J. O. Pettis, C. A. Prioli, H. C. West, D. B. Wyrick; Adjunct Associate Professor: E. D. Engel; Associate Professors Emeriti: E. P. Dandridge, J. B. Easley, H. A. Hargrave, C. E. Moore, A. B. R. Shelley, N. G. Smith; Assistant Professors: E. T. Amiran, C. E. Chaski, A. Davis, Gardner, V. C. Downs, B. A. Fennell, C. Gross, W. E. Haskin, S. B. Katz, R. C. Kochersberger, R. C. Lane, B. Mehlenbacher, J. E. Morrison, M. E. Orr, A. M. Penrose, N. B. Rich, L. R. Severin, J. J. Small, J. F. Thompson, J. M. Unsworth, *Senior Lecturer: P. R. Cockshutt, Lecturers: N. Caudle, N. Cooke, B. Forcey, J. Griffin, G. Hammill, D. Jones, N. H. Margolis, S. Martin, G. Maxwell, T. R. McLaurin, G. L. Minion, D. Perkins, J. Russell, S. Suchman, N. Tilly, L. Wooten.***

The Department of English offers basic and advanced courses in writing, language, and literature. The freshman courses, taken by all undergraduate students, develop skill in expository writing and in analytical reading of literary and non-literary works. Advanced courses in communication of technical information, composition and rhetoric, and creative writing give students opportunities to pursue special personal and career interests, as do courses in literature, linguistics, film, and folklore.

The department offers a Bachelor of Arts major in English with three options: literature and language, writing and editing, and teacher certification. It also offers a Bachelor of Science major.

Also available to undergraduates are a minor in English, a minor in Comparative Literature (offered jointly with the Department of Foreign Languages and Literatures), a minor in Linguistics (offered jointly with the Department of Languages and Literatures), a minor in Film Studies (offered jointly with the Department of Communication and the Division of Multidisciplinary Studies), and a minor in Journalism (offered jointly with the Department of Communication). An internship program combines work experience with courses in writing and editing.

In addition, the department offers two graduate degrees: a Master of Arts in English and a Master of Science in Technical Communication (see *Graduate Catalog* for details).

A five course certificate program in Professional Writing is available to students not seeking a degree at NCSU.

OPPORTUNITIES

A degree in English provides both vocational training and liberal education. It leads to careers in such fields as teaching, journalism, advertising, public relations, personnel management, technical writing, business writing, and creative writing. It sharpens the analytical and interpretive skills needed for strong business management, and it serves as an excellent pre-professional degree for students planning to study law or medicine and for those intending to do graduate work in literature and composition.

BACHELOR OF ARTS IN ENGLISH

Major in English—The student must schedule 42 semester hours beyond the usual six hours in freshman composition. Basic requirements include the sophomore survey of English literature, the sophomore survey of American literature, a course in Shakespeare, and a seminar in literary criticism. Beyond these courses, the student may pursue special interests within the limits of recommended categories.

Major in English, Writing and Editing Option The student must schedule 42 semester hours beyond the usual six hours in freshman composition. Courses include journalism, copyediting, advanced writing, literature, and, in the final semester, a seminar in writing and editing (ENG 495). Additionally the student must schedule 15 to 18 semester hours in a chosen track or discipline outside the department.

Major in English, Teacher Education Option—English majors may enroll in the teacher education option offered by the College of Humanities and Social Sciences in cooperation with the College of Education and Psychology. Students who complete this program are eligible to apply for the certification to teach English in secondary schools in North Carolina. The requirements of the program include 35 semester hours in professional courses and 33 semester hours in English beyond the usual six hours in freshman composition. (Total 127 credit hours required for graduation.) Students desiring to enter this program should declare their intention before the spring of the sophomore year. Students are required to file a formal application for admission which must be approved in order for them to participate. Enrollments in the Teacher Education Option may be limited.

BACHELOR OF SCIENCE IN ENGLISH

Concentration in English—The student, in consultation with his or her department adviser, must schedule 27 semester hours beyond the usual six hours in freshman composition.

MINOR IN ENGLISH

The English Department offers a minor in English to majors in any field except English. To complete the minor, fifteen hours of English courses are required above the 100 level, six hours of which must be at the 300 level or above. A grade of C or better is required in all courses credited to the English Minor.

MINOR IN COMPARATIVE LITERATURE

The Departments of English and of Foreign Languages and Literatures offer a minor in Comparative Literature to all undergraduate students. It requires six courses: FL 350, CL 495, and four courses in one or more literatures (other than a student's major) chosen from an approved list. A grade of C or better is required in all courses.

MINOR IN FILM STUDIES

The Departments of English and of Communication and the Division of Multidisciplinary Studies offer a minor in Film Studies. The minor provides an introduction to the nature of the film experience, some background in the history of the medium, and the opportunity for in depth study of selected topics. Fifteen hours of course work are required

to complete the minor: ENG 282 and either COM 364 or COM 374, plus nine credit hours selected from the following: ENG 382, ENG 492, COM 244, COM 364 or 374 (whichever course was not taken to fulfill the requirement above), MDS 480, HI 336, and DN 316 (prerequisite waived, consent of instructor). Any student taking this minor cannot count courses from the minor toward his or her major.

MINOR IN JOURNALISM

With the Department of Communication, the Department of English offers a minor in Journalism, open to students in any major. It consists of the following courses: ENG 214, ENG 215, ENG 315, COM 204, and one of the following: COM 234, COM 334, COM 421. A grade of C or better is required in all courses.

MINOR IN LINGUISTICS

The Department of Foreign Languages and Literatures and the Department of English offer a minor in Linguistics to majors in any field. Among students likely to be attracted to the minor are those interested in Second Language Acquisition. To complete the minor fifteen hours of designated courses are required, as well as the completion of a foreign language through the 202 level.

FOREIGN LANGUAGES AND LITERATURES

1911 Building (Room 120)

Professor J. H. Stewart, Head of the Department

Associate Professor A. C. Malinowski, Assistant Head of the Department and Coordinator of Advising

Professor G. G. Smith, Scheduling Officer

Professors T. P. Feens, G. F. Gonzalez, J. R. Kelly, G. G. Smith, J. H. Stewart, M. A. Witt; Professors Emeriti, A. A. Gonzalez, M. Paschal, G. W. Poland, E. M. Stack; Associate Professors: R. A. Alder, S. T. Alonso, W. M. Holler, M. M. Magill, A. C. Malinowski, L. A. Mykyta, Y. B. Rollins, S. E. Simonsen, M. L. Sosower; Associate Professors Emeriti: V. M. Prichard, H. Tucker Jr.; Assistant Professors: J. C. Akers, V. Bilenkin, H. G. Braunbeck, G. A. Dawes, D. M. Marchi, J. P. Mertz, M. L. Salstad, S. Yamahash; Lecturers: D. F. Adler, F. Kashimura, A. B. Kennedy, Q. Q. Sun; Instructors: D. J. Mennell, G. P. Meyjes.

OPPORTUNITIES

The expansion of international relations makes the knowledge of foreign languages a critical need for today's professional. The student of foreign languages is not limited to teaching, translating or interpreting. There are careers in politics, diplomacy, commerce, banking, agriculture, science, and research in which a thorough knowledge of foreign languages is crucial for success. The demand for multilingual personnel extends to all fields of human enterprise and will continue to grow in the coming years.

BACHELOR OF ARTS IN FRENCH OR SPANISH

All the general requirements for the Bachelor of Arts degree must be met, including six hours of literature survey within the Department of Foreign Languages and Literatures or in British and American literature or any combination of these. Degree designations are: B.A. in French Language and Literature, B.A. in Spanish Language and Literature, B.A. in French Language and Literature with Teacher Education Option, and B.A. in Spanish Language and Literature with Teacher Education Option.

Outstanding students may become members of Alpha Lambda, campus chapter of Phi Sigma Iota, National Foreign Languages Honor Society; of Xi Omicron, campus chapter of Sigma Delta Pi, National Hispanic Honor Society; and of Gamma Alpha, campus chapter of Dobro Slovo, National Slavic Honor Society. A departmental honors program in French and Spanish is also available to eligible students.

Major in French or Spanish—Students must complete 36 hours beyond the 201 level, including a senior seminar. Majors must take 12 additional hours of advised electives. These are waived for double majors (such as Business and Spanish or Business and French) and for the Teacher Education Option.

Major in French or Spanish with Teacher Education Option In collaboration with the College of Education and Psychology and the Department of Curriculum and Instruction, the department offers a program leading to a French or Spanish teaching license in North Carolina, grades K-12. The requirements of the program include 30 semester hours in professional education classes and 39 semester hours in French or Spanish beyond the 102 level. Candidates must consult with their academic adviser as early as possible for the proper planning of their curriculum. Application for admission to Teacher Education Candidacy is made during the spring semester of the sophomore year. Enrollment in the Teacher Education Option programs may be limited.

PROGRAMS ABROAD

The department offers summer programs in Austria, Mexico, and Germany and a semester-long program in Spain.

MINOR IN CLASSICAL STUDIES

The minor in Classical Studies offers an excellent foundation for advanced work in other academic disciplines as well as professional programs in law, medicine and finance. The minor gives students an opportunity to develop a keener perception and better understanding of the cultural forces at work in the contemporary world. And by presenting a broad selection of courses in the various disciplines of literature, philosophy and history, the minor provides students with a sound introduction to studies in antiquity. Requirements for the minor include five courses selected from the following: GRK 201 *or* LAT 201; GRK 310 *or* GRK 320; PHI 300 *or* REL 312; HI 403 *or* HI 404; and HI 405 *or* 406.

MINOR IN COMPARATIVE LITERATURE

(See Department of English)

MINORS IN FOREIGN LANGUAGES, LITERATURES, AND CULTURES

Minor programs in Chinese, French, German, Italian, Japanese, Russian, and Spanish involve fifteen hours of study at the 201 level and beyond. A minor program in Classical Greek is also offered and involves fifteen hours of study at the 101 level and beyond. Programs include courses in language, literature, and civilization. Students majoring in any area of study at NCSU are eligible to minor in a foreign language. Students may not, however, major and minor in the same language.

MINOR IN LINGUISTICS

(See Department of English)

HISTORY

Harrelson Hall (Room 162)

Professor W. C. Harris, *Head of the Department*

Assistant Professor J. E. Crisp, *Assistant Head of Department*

Associate Professor J. A. Mulholland, *Coordinator of Advising*

Alumni Distinguished Undergraduate Professors: B. F. Beers, J. P. Hobbs

Alumni Distinguished Professor (for graduate teaching): J. D. Smith

Professors: J. R. Banker, B. F. Beers, C. H. Carlton, A. J. De Grand, M. S. Downs, W. C. Harris, J. P. Hobbs, A. J. La Vopa, L. O. McMurry, G. D. Newby, J. K. Ocko, S. T. Parker, J. M. Riddle, R. H. Sack, R. W. Slatta, J. D. Smith, E. D. Syla, K. S. Vincent. *Professors Emeriti:* M. L. Brown, R. W. Greenlaw, D. E. King, L. W. Seegers, M. E. Wheeler, B. W. Wisby. *Associate Professors:* D. P. Gilmartin, W. A. Jackson, W. C. Kimler, K. P. Luria, J. A. Mulholland, G. W. O'Brien, S. L. Spencer, G. D. Surh, K. P. Vickery. *Associate Professor Emeritus:* R. N. Elliott. *Associate Members of the Faculty:* A. Lumpkin, F. A. Meyer, R. B. Mullin. *Assistant Professors:* J. E. Crisp, S. Middleton, P. Tyler. *Adjunct Assistant Professors:* V. L. Berger, J. W. Caddell, J. J. Crow, W. S. Price, Jr., D. J. Olson, H. K. Steen. *Lecturer:* J. Woodard.

An understanding of the historical background of our times is expected of the educated person. The Department of History makes it possible for students to gain this understanding through a wide range and variety of courses at all levels from introductory through graduate.

A broad offering of introductory courses is available to satisfy the undergraduate history requirement or part of the humanities and social sciences requirements in most university curricula. Students in the College of Humanities and Social Sciences are required to take two courses in history—one dealing with a culture significantly different from our own in pre-industrial Western or non-Western societies and the other dealing with our own culture in the United States or post-industrial Western societies.

Honors students are eligible for membership in Phi Alpha Theta, the national history honorary society. Some introductory and advanced courses and most graduate courses are offered in the evening.

The department offers two Master of Arts degrees. Students interested in enhancing their understanding of history, obtaining advanced teaching credentials, or pursuing doctoral work elsewhere may take the traditional graduate program. Students interested in applied history may take the public history program. Some financial assistance is available.

OPPORTUNITIES

A history major has traditionally served as a foundation for careers in such professions as teaching and law. In recent years undergraduates have frequently augmented studies in history with computer science, foreign language, or business administration, combinations which have proved attractive in business and government service. The prospect of new career ladders in public education has prompted renewed interest in a M.A. in history with advanced teaching certification. Multiplication of records of every kind has created a steady demand for historians with master's degrees in applied or public history.

BACHELOR OF ARTS IN HISTORY

Major in History A history major must take 30 hours of course work in history in addition to the six hours required of all students in the College of Humanities and Social Sciences. These 30 hours must include a 491 seminar. At least 24 of the 30 hours must be at the 400 level. Sufficient courses are offered to complete the history requirements for the B.A. in the evening.

Major in History with Social Studies Teacher Education Option—History majors may enroll in the teacher education program offered by the College of Humanities and Social Sciences in cooperation with the College of Education and Psychology. Students who

complete this program are eligible for certification to teach social studies in secondary schools in North Carolina. In addition to the Bachelor of Arts degree requirements, students are required to take professional courses in education and psychology and additional social sciences courses (132 credit hours required for graduation). Students desiring to enter this program should declare their intention during their sophomore year. Admission is competitive and the criteria include an overall grade point average of 2.75 or better. Enrollments may be limited in Teacher Education Option Programs.

BACHELOR OF SCIENCE IN HISTORY

A concentration in history involves 18 hours of course work beyond the six hours required of all students in the College of Humanities and Social Sciences plus a senior seminar. Of the 18 hours, at least 12 must be at the 400 level.

MINOR IN HISTORY

A minor in History shall consist of six courses in history; one introductory course in pre industrial or non-Western history (i.e., HI 207, 208, 209, 215, 216, 263, 264, 275, or 276); one introductory course in United States or post-industrial Western history (i.e., HI 205, 210, 221, 222, 233, 251, or 252); four three-hour courses in history at the 300 level or above, two of which must be on the 400 level. All six courses must be completed with a grade of C or better to satisfy the requirements of the minor.

MULTIDISCIPLINARY STUDIES

Harrelson Hall (Room 145)

Professor C. D. Korte, Head of the Division

Associate Professor T. N. Hammond, Assistant Head of the Division

Professors: D. A. Adams, J. A. Gomez, D. B. Greene, C. D. Korte; Professors Emeriti: A. C. Barefoot, J. R. Lambert, Jr.; Associate Professors: T. N. Hammond, R. L. Hoffman; Assistant Professors: B. H. Grimes, R. A. Waschka, II, P. W. Hamlett; Lecturers: E. Malloy Hanley, C. L. Stalnaker.

Multidisciplinary Studies is an academic unit responsible for interdisciplinary programs dealing with contemporary and historical issues and problems. Courses are taught by teams of faculty drawn from the division and from the academic disciplines relating to the problems or issues under consideration. These courses are open to students in all curricula. In addition, the Social Work Program is administered as part of the Division of Multidisciplinary Studies.

BACHELOR OF ARTS IN MULTIDISCIPLINARY STUDIES

Multidisciplinary Studies Degree Committee:

Associate Professor T. N. Hammond (Multidisciplinary Studies and Foreign Languages and Literature), Chair

Associate Professor J. A. Mulholland (History)

Associate Professor A. C. Malinowski (Foreign Languages and Literatures)

Associate Professor M. S. Thompson (Sociology and Anthropology)

Associate Professor T. L. Honeycutt (Computer Science)

Lecturer C. B. Kimbrough (Business Management)

Lecturer C. L. Stalnaker (Multidisciplinary Studies)

The Multidisciplinary Studies program allows a student to design his or her own academic major. Instead of following the requirements for a major in one of the traditional disciplines, the candidate for the Bachelor of Arts degree in Multidisciplinary Studies has the responsibility of organizing a concentration or field specialization from one or more disciplines. A concentration in Latin American Studies might, for example, combine related courses in language, literature, history, economics, sociology, and political science.

Two concentrations have been established primarily for the benefit of evening students. These are 1) American Studies: Cultural, Social, and Political and 2) Business Organization and Communication. All courses required for completion of these concentrations will be available in the evening.

The freshman and sophomore basic requirements for the Multidisciplinary Studies program are the same as for the other Bachelor of Arts programs in Humanities and Social Sciences. In satisfying basic requirements in language, humanities, social science, mathematics, and natural science, the student should, whenever possible, choose those courses that are most appropriate as background for the courses in his or her major concentration.

ADMISSION TO THE PROGRAM

To become a candidate for a major in Multidisciplinary Studies, a student first secures application forms and information from the office of the Division of Multidisciplinary Studies (145 Harrelson), then prepares a tentative proposal which includes a list of courses comprising 30 credit hours and an essay of 300 to 500 words explaining his or her reasons for desiring to make this set of courses the field of specialization. The student's proposal is reviewed by a faculty sponsor and submitted to the Multidisciplinary Studies Degree Committee for consideration. After a thorough examination to determine whether the set of courses proposed as a multidisciplinary major is academically sound and coherent, the committee will recommend that the Dean of Humanities and Social Sciences accept the proposal; or it will be sent back to the student and his or her sponsor with suggestions for modification and resubmission.

MINOR IN AFRICAN-AMERICAN STUDIES

The African American Studies Minor provides a comparative and interdisciplinary study of the Black experience in Africa and the Americas. Three required courses include an Introduction to African American Studies (MDS 240), Black American Literature (ENG 248), and Afro American History (HI 372 or 373). Two elective courses may be selected from a list of designated courses in such disciplines as anthropology, history, language, sociology, social work, and communication. The minor is designed to bring together students from diverse backgrounds and curricula who share a common interest in the African American experience.

MINOR IN ENVIRONMENTAL SCIENCE

This minor provides an opportunity for non-science majors to acquire basic understanding of the interrelationships between humans and the environment. It includes natural and social science courses that help to integrate disciplines and provide the foundation for analyzing environmental issues.

MINOR IN FILM STUDIES

(See Department of English)

MINOR IN SCIENCE, TECHNOLOGY, AND SOCIETY

The Science, Technology, and Society minor is a fifteen hour, multidisciplinary minor providing students an opportunity to appreciate and understand better the roles that science and technology play in the larger sociocultural context. A goal of the minor is to help students develop the ability to order and integrate the diverse aspects of their educations. Two essential components of this ability are sensitivity to the moral dimensions of scientific and technological inquiry as affecting how people may live or want to live and an appreciation of the practical implications of scientific and technical theory. In addition, the Science, Technology, and Society minor enables students to increase the breadth of their familiarity with science and technology.

MINOR IN WOMEN'S STUDIES

The Women's Studies minor offers all students in the university the opportunity to study the role of women in society. The minor will enable students to develop a better understanding of how women's positions in various societies have arisen and evolved.

PHILOSOPHY AND RELIGION

Winston Hall (Room 101)

Professor E. A. Martin, Head of the Department

Associate Professor L. M. Antony, Assistant Head of the Department

Professor A. D. VanDeVeer, Coordinator of Advising

Alumni Distinguished Undergraduate Professors: W. R. Carter, T. H. Regan

Professors: W. R. Carter, E. A. Martin, T. H. Regan, A. D. VanDeVeer; Professors Emeriti: P. A. Bredenberg, R. S. Bryan; Associate Professors: W. Adler, L. M. Antony, D. F. Austin, R. M. Hambourger, B. B. Levenbook, H. D. Levin, J. Levine, R. B. Mullin, C. M. Pierce, T. K. Stewart; Associate Professors Emeriti: W. C. Fitzgerald, W. L. Hughfill, R. S. Metzger; Assistant Professors: D. D. Auerbach, M. K. Cunningham, D. M. Joseph, A. Reath.

The Department of Philosophy and Religion at North Carolina State University renders two major services to its students. (1) In the discipline of philosophy, it offers an array of courses which examine the great philosophic ideas of Western civilization, and in the discipline of religion, it offers courses which examine the religious concepts and principles that have had an impact on all of civilization. (2) It provides an opportunity for extensive technical study in philosophy for students who wish to concentrate in this field either for its own sake or as an ideal intellectual foundation for subsequent graduate or professional study.

HONORS PROGRAMS IN PHILOSOPHY

The Department of Philosophy and Religion offers an Honors Program to provide an opportunity for qualified students to pursue a more challenging and individualized course of study.

Students who qualify may elect to take as little as one course on an honors basis. However, those students who desire to enroll in the honors program and to have their transcripts include the words, "With Honors in Philosophy," are required (1) to complete a major in philosophy, and (2) to complete satisfactorily a minimum of fifteen hours (including Philosophy 335) of honors work. Students pursuing these goals will be referred to as "students seeking honors in philosophy."

HONORS PROGRAM IN RELIGIOUS STUDIES

The Department of Philosophy and Religion offers an Honors Program in Religious Studies to provide an opportunity for qualified students to pursue a more challenging, individualized, and directed course of study than that afforded by the general Area of Concentration in Religious Studies.

Students who qualify may elect to take as little as one course on an honors basis. However, those students who desire to enroll in the honors program and to have their transcripts include the words, "With Honors in Religious Studies" are required to (1) complete the degree program for Philosophy with an Area of Concentration in Religious Studies, and (2) to complete a minimum of twelve credit hours of honors work in Religious Studies. Students pursuing these goals will be referred to as "students seeking honors in religious studies."

SCHOLARSHIP

The Claire Simmons Allan Samson Memorial Scholarship in Moral Philosophy, a renewable scholarship of \$1000 per year, will be awarded annually to worthy students who have expressed an interest in issues in animal rights.

OPPORTUNITIES

For students interested in postgraduate study, information compiled by post-college professional schools reveals that undergraduate philosophy majors who apply to graduate schools of management have in the past scored extremely well in combined total scores on the Graduate Management Admission Test, with exceptional scores on verbal fields. Those undergraduate philosophy majors who apply to law schools have been shown to be more likely to be admitted than virtually any other field represented, and medical schools have also shown a significant preference for philosophy majors in their admissions. Students intending to study philosophy in graduate programs have consistently scored much higher than other students on the verbal section of the Graduate Record Examination. Because of this capability of scoring so well on the various postgraduate tests, many businesses and industries welcome philosophy majors into their training programs.

BACHELOR OF ARTS IN PHILOSOPHY

Candidates for the Bachelor of Arts degree in Philosophy must complete 30 hours in philosophy, including either Logic (PHI 201) or Symbolic Logic (PHI 335); the courses in the development of Western philosophic thought (PHI 300, 301), a course in value theory (PHI 275, 308, 309, 311, 312, 313, 314, 321, 322) and a course in contemporary philosophy (PHI 319, 331, 332).

Major in Philosophy with a Concentration in Religious Studies—This program is designed especially to prepare students for theological seminary or graduate work in religion as well as to introduce them to the discipline of religious studies. Candidates for the Bachelor of Arts degree in Philosophy with a concentration in Religious Studies must complete 33 hours, including 12 hours in philosophy and 21 hours in religion. The courses in philosophy must include a course in the development of Western philosophic thought (PHI 300, 301); a course in value theory (PHI 275, 308, 309, 311, 312, 313, 314, 321, 322); and the course in the philosophy of religion (PHI 305). The courses in religion must include a course in biblical studies (REL 201, 311, 312); a course in non Western religions (REL 331, 332, 407, 408); a course in the history of Western religion (REL 317, 318, 320, 323, 324, 326); and a course in theology and culture (REL 309, 327).

Major in Philosophy with a Concentration in Philosophy of Law—The program is designed to help students develop the ability to think critically about the role of the law and the values that it reflects. Because of its interdisciplinary nature, it provides a strong foundation for professional legal education. The concentration requires a minimum of 30 hours in philosophy (including the course taken to meet school requirements) and a minimum of 9 hours in political science. Three advised electives are required in addition to five core courses: PHI 309, PHI 312, PHI 313, PS 308 and PS 361. Four background courses, which are required of all Philosophy majors, must also be taken: either PHI 201 or PHI 335, PHI 300, PHI 301, and either PHI 319, PHI 331, or PHI 332.

BACHELOR OF SCIENCE IN PHILOSOPHY

Candidates for the Bachelor of Science degree in Philosophy must complete 27 hours in philosophy. These must include the courses in the history of Western philosophic thought (PHI 300, 301), Symbolic Logic (PHI 335), Philosophy of Science (PHI 340); and a course in value theory (PHI 275, 308, 309, 311, 312, 313, 314, 321, 322).

MINORS IN THE DEPARTMENT OF PHILOSOPHY AND RELIGION

Students wishing to take any of the following academic minors need to complete the departmental form declaring intention to do so.

MINOR IN COGNITIVE SCIENCE

Students who take a minor program in Cognitive Science are required to complete with a grade of C or better fifteen hours of courses, distributed as follows: PSY 320 (Cognitive Processes); PSY 340 (Environmental Ergonomics) or PSY 546 (Human Information Processing); PHI 331 (Philosophy of Language); PHI 332 (Philosophy of Psychology); PHI PSY 425 525 (Introduction to Cognitive Science).

MINOR IN PHILOSOPHY

Students who take a minor program in Philosophy are required to complete with a grade of C or better fifteen hours of courses in selected fields in philosophy, including (1) a course in the history of philosophy (3 credit hours), (2) a course in normative (ethics and ethics related) philosophy (3 credit hours), (3) a course other than one in normative philosophy, but not including logic or the history of philosophy (3 credit hours).

MINOR IN RELIGIOUS STUDIES

Students who take a minor program in Religious Studies are required to complete with a grade of C or better fifteen hours of courses in selected fields of religious studies. In order to ensure a wide study of the field, students are required to select at least one course in Western religious traditions and at least one course in non Western religious traditions. REL 101 and REL 102 may not be counted in the minor.

PHYSICAL EDUCATION

Carmichael Gymnasium (Room 2000)

Professor A. Lumpkin, Head of the Department

Professors: A. Lumpkin; Professors Emeriti: F. R. Drews, R. A. Lauffer, Associate Professors: S. V. Almekinders, A. L. Berle, H. L. Brown, J. M. Daniels, J. L. DeWitt, T. W. Evans, V. M. Leath, C. E. Patch, J. L. Shannon; Associate Professors Emeriti: N. E. Cooper, J. B. Edwards, A. M. Hoch, H. Keating, W. R. Leonhardt, W. H. Sonner; Assistant Professors: A. Attarian, J. V. Brothers, R. C. Combs, K. L. Davis, R. G. Gwyn, S. C. Hastead, J. W. Isenhour, Jr., G. W. Pollard, T. C. Roberts, R. R. Smith; Assistant Professors Emeriti: M. S. Rhodes, W. M. Shea, E. A. Smaltz; Lecturers: J. K. Bartlett, R. N. Bechtolt, A. L. Bell, J. R. Bonner, W. A. Cheek, J. L. Coleman, K. K. Criswell, R. H. Kidd, M. R. Lester, I. F. Ormond, III, C. S. Ousley, D. L. Peterson, C. E. Raynor, T. M. Reichardt, H. L. Roberson, E. V. Smith, P. L. Smith, J. W. Stewart, R. L. Sutton, R. H. Taylor, G. E. Wall, T. C. Winslow, G. R. Youtt; Associate Members of the Faculty: D. L. Ridgeway (Statistics and Physics), C. E. Stoddard.

All North Carolina State University students are required to complete four semesters of physical education to meet graduation requirements. Freshmen are expected to take PE 100, Health and Physical Fitness, in either the fall or the spring semester of their freshman year. Students who do not pass a survival swimming test must enroll in and attempt to pass a beginning swim class. Students may participate in a sport they know or learn a totally new activity. Students with disabling conditions will be helped by physical education and Student Health Service professionals in choosing appropriate classes. Only "activity" courses, not elective "theory" courses, can be used to meet the university physical education requirement.

MINOR IN PHYSICAL EDUCATION (COACHING EMPHASIS)

The Department of Physical Education offers a 20 hour minor in Physical Education (Coaching Emphasis), designed to prepare students to assume coaching responsibilities with a sound theoretical background. The minor provides knowledge of pertinent anatomical, physiological, and biomechanical principles; appreciation for the prevention and treatment of athletic injuries; development of observation and communication skills; and demonstration of motor skills and strategies involved in coaching specific sports.

POLITICAL SCIENCE AND PUBLIC ADMINISTRATION

Caldwell Hall (Room 211)

Professor M. S. Soroos, Head of the Department

Professor J. H. Svava, Director of Master of Public Affairs Program

Associate Professor H. G. Kebschull, Director of Master of Arts Program

Alumni Distinguished Undergraduate Professors: A. Holtzman, J. P. Mastro

Professors: G. D. Garson, A. Holtzman, J. P. Mastro, E. R. Rubin, M. S. Soroos, J. H. Svava, D. W. Stewart, J. O. Williams; Professors Emeriti: W. J. Block, J. T. Caldwell; Associate Professors: C. K. Coe, D. M. Daley, R. H. Dorff, J. H. Gilbert, H. G. Kebschull, S. H. Kessler, J. M. McClain, E. O'Sullivan, T. V. Reid, J. E. Swiss, M. L. Vasu; Associate Professor Emeritus: K. S. Peterson; Assistant Professors: C. E. Griffin, R. S. Moog.

The Department of Political Science and Public Administration offers basic and advanced courses in all major fields of the discipline: American government and politics (local, state, and national), public law and criminal justice, public administration, comparative politics, international relations and global issues, political theory, and methodology of political science. The department affords opportunities for the study of government and administration to students in other curricula and schools.

Graduate courses in political science are available to advanced undergraduates. See listing of graduate degree programs and consult the *Graduate Catalog*.

The department provides opportunities for internships in state and local government including the North Carolina General Assembly Legislative Internship Program.

Majors in political science with distinguished academic achievements are annually invited to join Zeta Epsilon Chapter of Pi Sigma Alpha, the national political science honor society.

OPPORTUNITIES

There are a number of careers and professions for which a major in political science, or extensive study of government and politics, can be most useful. This is true especially for those planning to seek careers in teaching, the legal profession, criminal justice agencies, state and local government, urban planning, the federal bureaucracy, journalism or in any of the organizations that seek to monitor political processes or to influence the content of public policy. Private firms also seek managers and public affairs specialists who have a knowledge of the functioning of the political system and of politics in general.

BACHELOR OF ARTS IN POLITICAL SCIENCE

Major requirements are: 30 hours (in addition to any political science course which may be taken to satisfy the 12-hour social science requirement), 21 of which must be at the 300-level or above; PS 201 or equivalent; at least six hours in each of three pairs of subfields (Pair A: American Politics/Policy and Administration; Pair B: International or Comparative Politics; Pair C: Political Theory/Scope and Methods); and a Political Science Seminar.

Criminal Justice Option The Departments of Political Science and Public Administration and Sociology and Anthropology offer undergraduate majors an option in Criminal Justice. This option includes 28 semester hours of specialized study. The program develops students who may move into middle management and policymaking positions in agencies such as police, court correctional, probation and parole agencies.

Students interested in criminal justice should contact Dr. Robert Moog, 229 Caldwell Hall, Political Science and Public Administration or Dr. Matthew Zingraff, 312 1911 Building, Sociology and Anthropology.

Law and Political Philosophy Concentration—The concentration in Law and Political Philosophy is an interdisciplinary program designed for students who are interested in the theoretical and legal dimensions of political life. It seeks to develop a broad understanding of the relationship between law and politics and the moral and philosophical questions which are central to both. The Law and Political Philosophy concentration is fulfilled by successful completion of twelve hours of core course requirements, nine hours of recommended electives, and completion of the normal political science major requirements. Six hours of the core course requirements and at least three hours of the recommended electives will be taken in the Department of Philosophy and Religion. Courses in the concentration provide a humanistic perspective on legal and political questions. The program is suitable for those interested in a career in law or government or those who hope to pursue graduate studies in either political science or philosophy.

Social Studies Teacher Education Option—A major in political science may also choose a Teacher Education option. This is a 131 credit hour degree program which includes the normal 30-hour major plus the required professional education courses. Successful completion of the program leads to certification to teach social studies in the secondary schools. Enrollments may be limited in the Teacher Education Option program.

BACHELOR OF SCIENCE IN POLITICAL SCIENCE

The major requirements for a B.S. degree in Political Science are identical to the B.A. except that 27 hours of course work in the discipline are required instead of 30.

MINOR IN POLITICAL SCIENCE

A minor in Political Science may be elected by students from any curriculum. The minor requires 15 hours of political science courses, which must include 9 hours at the 300 level or above and a 400 level seminar course. At least three hours must be from each of two of the following three pairs of subfields (Pair A: American Politics Policy and Administration; Part B: International or Comparative Politics; Pair C: Political Theory Social Science Methods).

SOCIAL WORK PROGRAM

1911 Building (Room 232)

Professor P. Nelson Reid, Head of the Program

Lecturer Linda R. Williams, Coordinator of Advising and Admissions

Professor: P. N. Reid; Associate Professor Emeritus: I. E. Russell; Assistant Professors: J. S. Brown, J. P. Murray, Lecturer: L. R. Williams; Adjunct Instructors: D. Courtney, M. Deyampert, W. Dubrick, J. Haire.

The Social Work Program is fully accredited by the Council on Social Work Education and offers the Bachelor of Social Work (BSW) degree. Students complete a curriculum based on the liberal arts; and it incorporates a professional foundation, including social work practice, human behavior and diversity, community social services, social policy, and research methods. Optional courses offer opportunities to study various social work practice areas in depth, such as child welfare, health care, multicultural practice, black family, and school social work. Students will complete several volunteer experiences and a 480-hour field placement in a social service setting. A minor in Social Work is available.

The purpose of the Social Work Program is to prepare students for entry-level professional practice in social work or for advanced graduate level academic work. The curriculum includes 59 to 61 hours in English composition, literature, history, natural science, mathematics, foreign languages, philosophy, social sciences, and physical education. Thirty six hours of core social work courses, three hours of social work electives, 10 hours of sociology and statistics, and 14 to 16 hours of free electives complete the 124-hour graduation requirement.

The Social Work Program is administered through the Division of Multidisciplinary Studies.

OPPORTUNITIES

Social work is an exciting, challenging, and dynamic profession. No matter what the political climate or the changing nature of personal or social need, social workers will be in demand. Social workers are employed in a variety of settings which include health care, mental health, services to the aging, child welfare, public welfare, substance abuse, public schools, developmental disabilities, and many other public and private settings. In each of these areas there is recognition of the necessity for professional preparation, and the BSW graduate is often looked upon as the right sort of person for a career in these areas of practice. North Carolina, and 42 other states, have licensing or certification procedures for social work practice. Graduation from the Social Work Program makes the student eligible for such licensing or certification.

MINOR IN SOCIAL WORK

The minor is designed to familiarize students with the social service system, major social welfare programs, and elements of the profession of social work. The student will take five required courses and select one additional course from elective offerings which present the contribution of professional social work in a number of settings.

SCHOLARSHIP

The Social Work Program selects an annual Rosemary Anne Fike Merit Scholarship recipient each spring to recognize the junior or senior who represents both academic accomplishment and service through the Student Social Work Association.

STUDENT ACTIVITIES

The Student Social Work Association (SSWA) is open to all social work majors. SSWA meets regularly and provides an opportunity for students to socialize and become involved in the professional community outside the school. The organization is involved in a wide variety of campus and community activities, such as fundraising, lobbying, volunteering, and service projects. SSWA provides funds for students to attend professional conferences and meetings. SSWA is a program unit of the National Association of Social Workers, North Carolina chapter, and students have served as elected representatives to the board of directors of the chapter. The SSWA is active and aids in maintaining a sense of unity and purpose among the students.

ADMISSION TO THE PROFESSIONAL DEGREE PROGRAM

The Social Work faculty is committed to helping all entering students evaluate career goals and objectives to ensure that the students meet minimum academic standards, have goals and objectives compatible with the major, and know specifically what the profession of social work is in terms of its philosophy, value base, and fields of practice. The admissions procedure is intended to strengthen the student's certainty regarding career choice and to enhance the student's focus and sense of purpose in curriculum planning. Specific components of the admissions procedure include: 1) completion, with a grade of C or better, any 200-level Social Work course; 2) participation in an orientation session; 3) completion of the application for admission; and 4) a personal interview with a faculty advisory committee.

The *Social Work Program Student Handbook* spells out further details of this procedure, as well as other elements of the Social Work Program.

BACHELOR OF SOCIAL WORK PROGRAM

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
SOC 2	3	SW 203 Dev. of Social Welfare	3
SW 201 Com. Social Services	3	History ¹	3
History ¹	3	Mathematics ¹	3-4
Mathematics ¹	3-4	Philosophy ⁴	3
PE 100 Health and Physical Fitness	1	Physical Education	1
	16		16
	17		
SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ANT 252 Cultural Anthropology	3	GN 301 Genetics	3
BS 105 Biology	4	SW 307 Econ. Sec. Prog.	3
FL-201 Cultural Anthropology	3	SW 310 Human Behav. for SW	3
SW 205 Soc. Wel. Contemp Am	3	Literature ¹	3
Literature ¹	3	PS EC Elective	3
Physical Education	1	Physical Education	1
	17		16
JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
FS 301 Nutrition	3	SOC 300 Research Methods	4
SOC 305 Race Relations	3	SW 320 Practice I*	3
ST 311 Statistics	3	SOC 300 400 Elective	3
SW Elective	3	Elective	3
Elective	3	Elective	3
	15		16
SENIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
SW 405 SW Practice II*	3	SW 406 Field Work I*	6
SW 420 Legal Aspects	3	SW 407 Field Work II*	6
PSY Elective	3		
Elective	3		
Electives	2-4		
	14		
	16		

Minimum Hours Required for Graduation 124

¹These general education requirements are the same as those in the B.A. programs offered by the College of Humanities and Social Sciences. The BSW requires completion of two courses in mathematics above MA 101.

⁴Practice and Field Work courses must be taken in successive semesters. Field Work I and II are offered in both fall and spring semesters, but must be taken together during the last semester.

SOCIOLOGY AND ANTHROPOLOGY

(See also Agriculture and Life Sciences)

1911 Building (Room 301)

Professor W. C. Clifford, *Interim Head of the Department*

Associate Professor M. T. Zingraff, *Interim Associate Head*

Associate Professor A. C. Davis, *Undergraduate Coordinator (Applied Sociology)*

Professor M. D. Schulman, *Director of Graduate Programs*

Associate Professor R. J. Thomson, *Undergraduate Administrator*

Associate Professor S. K. Garber, *Extension Specialist in Charge*

SOCIOLOGY TEACHING, RESEARCH AND EXTENSION FACULTY

Professors W. C. Clifford, L. R. Della Fave, V. A. Hiday, R. L. Moxley, L. B. Otto, M. M. Sawhney, M. D. Schulman, R. C. Wimberley; *Professors Emeriti* J. N. Collins, E. M. Crawford, T. N. Hobgood Jr., C. P. Marsh, P. P. Thompson, O. Uzrell, M. E. Voland, J. N. Young; *Associate Professors* M. P. Atkinson, R. C. Brisson, F. R. Czaja, A. C. Davis, S. K. Garber, G. D. Hill, T. J. Hoban, J. C. Leiter, S. C. Lilley, M. S. Thompson, R. J. Thomson, D. T. Tomaskovic-Devey, K. M. Troost, F. M. Woodrum, M. T. Zingraff; *Assistant Professors* P. L. McCall, M. L. Schwalbe, C. R. Zimmer; *Assistant Professors Emeriti* C. G. Dawson, T. M. Hyman; *Associate Member of the Faculty* R. D. Mustian (Adult and Community College Education)

ANTHROPOLOGY RESEARCH AND TEACHING FACULTY

Associate Professor J. M. Wallace, *Coordinator*

Associate Professors G. S. Nickerson, I. Rovner, M. L. Walek; *Associate Professor Emerita* J. G. Peek; *Assistant Professor* R. S. Ellovich

The Department of Sociology and Anthropology offers introductory and advanced courses in sociology and anthropology covering the major sub-fields of the two disciplines. It also offers supervised field work and practicum experiences required for certain curricula in the department.

Aims of the departmental offerings are: (1) to provide majors with academic background and experience useful for many careers in government and industry or for pursuing advanced academic work (for a description of the graduate degrees offered by the department, see the *NCSU Graduate Catalog*) and (2) to provide service courses to students in other curricula and to Lifelong Education students.

The department, jointly administered by the Colleges of Humanities and Social Sciences and Agriculture and Life Sciences, offers seven undergraduate curricula. The four curricula administered by the College of Humanities and Social Sciences are: Bachelor of Arts in Sociology, Bachelor of Arts in Sociology with Criminal Justice option, Bachelor of Arts in Sociology with Social Studies Teacher Education option, and Bachelor of Arts in Sociology with Anthropology concentration.

BACHELOR OF ARTS IN SOCIOLOGY

The following departmental requirements must be met by all students majoring in sociology: A minimum of 31 hours in the major field including SOC 300, Social Research Methods; SOC 400, Theories of Social Structure; SOC 401, Theories of Social Interaction; at least three but no more than six credit hours of 200-level sociology courses; at least 15 credit hours of 400 level or above sociology courses including SOC 400 and SOC 401. *Note: In the LCS program (anthropology concentration), 3 credit hours at the 400 level or above are in anthropology.* Additional electives in sociology may be at the 300-level or above. ANT 252, Cultural Anthropology, is required. A second course in anthropology is strongly recommended. One course in statistics is also required.

Criminal Justice Option—The Criminal Justice Option seeks to develop a professional orientation that will be relevant both to occupational goals and participation as a citizen in

community affairs. Courses in both political science and sociology are included in a 28-hour block that provides a general background in crime causation and agencies of criminal justice plus the opportunity to select from more specific courses dealing with deviance, juvenile delinquency, the court system, correctional facilities, and the like, including field placement in an agency of the criminal justice system.

Social Studies Teacher Education Option—This curriculum prepares the student for state certification in social studies in the secondary school system. (132 hours required for graduation). The inclusion of a professional semester with practice teaching and the need for a broad base in the social sciences makes this a comparatively demanding program with somewhat less opportunity for free electives. Courses in education and psychology are taken beginning in the sophomore year in preparation for the teaching experience. The student learns the basic concepts of economics, political science, anthropology and history, as well as sociology. Enrollments in Teacher Education Option programs may be limited.

Anthropology Concentration—This concentration emphasizes the complementary nature of sociology and anthropology in understanding human behavior in social and cultural context. It encourages flexibility in selection from both anthropology (12 hours within the major plus 6 hours in the social science requirement) and sociology (22 hours) courses. The four anthropological subdisciplines of cultural anthropology, physical anthropology, archaeology, and linguistics are represented in the course offerings.

MINOR IN ANTHROPOLOGY

A minor in Anthropology focuses on the comparative study of human beings, with emphasis on both the physical and cultural aspects. A flexible selection of courses (15 credit hours) includes offerings from anthropological subdisciplines such as cultural anthropology, physical anthropology, archaeology, and linguistics.

MINOR IN SOCIOLOGY

This minor emphasizes sociological theory and research with substantive applications. The minor builds on theory and methodology and allows students flexibility in the choice of subdisciplines such as criminology, stratification, demography, social psychology, race and ethnic relations, or the family.



COLLEGE OF MANAGEMENT

Nelson Hall

R. L. Clark, *Interim Dean*

J. W. Rockness, *Associate Dean for Academic Affairs*

J. C. Poindexter, *Associate Dean for Research, Outreach, and Executive Education*

G. A. Hankins, *Coordinator, African American Affairs and Support Services*

The College of Management offers a variety of curricula which prepare young men and women to become leaders in a global business environment. Graduates of the College are well qualified for professional careers in accounting, banking, manufacturing management, marketing, sales, economic analysis, human resource management, quality management, environmental management, international business, and general management. Opportunities for employment include public entities, private industry, government agencies, and non-profit organizations. Many graduates pursue advanced studies in law, professional accounting, economics, and business administration.

There are three departments in the College: Accounting, Business Management, and Economics which together graduate more than 700 students annually. Four undergraduate degree programs are offered: BA in Accounting, BA in Business Management, and BA and BS in Economics.

The curricula provides all students with a broad liberal arts background combined with a strong concentration in accounting, business, or economics. Communication skills and computer usage are stressed throughout the coursework. The College faculty are dedicated to excellence in teaching and research. The outstanding faculty combined with innovative curricula provide young men and women with the opportunity to acquire the basic knowledge and management skills necessary to become leaders in the business world.

FACILITIES

The College has recently moved to Nelson Hall at the northwest corner of campus. This facility will offer students the opportunity to attend classes, meet faculty, and participate in College activities in one central building. A large computing lab provides students access to IBM PC's served by a local area network. The lab has access to a number of excellent databases including WordPerfect, Lotus 1 2 3, VP Planner Plus, EASYREG, PC-SAS, Gauss, LP 88, Harvard Graphics, and TSA88. The lab is open days, evenings, and weekends for student use. Computer terminals throughout the campus provide students access to mainframe computing 24 hours a day.

SCHOLARSHIPS

In addition to university-wide awards, the College has the following scholarships: Accounting Freshman Award of \$250 for entering freshmen, 10 Accounting Firms' Merit Awards of \$500 available to juniors majoring in accounting, Harris Wholesale Scholarship of \$1,000 available to juniors or seniors majoring in business management, and R. Ray Moore Scholarship of a variable amount available to rising juniors and seniors majoring in business management and economics.

ACADEMIC MINORS

All the departments offer academic minors which allow students to pursue recognized concentrations outside their major. Minors involve a minimum of 15 credit hours. Contact the appropriate academic department to obtain additional information about specific minors.

STUDENT ACTIVITIES

Students have the opportunity to join many management related organizations including Accounting Society, Alpha Kappa Psi (professional business fraternity), American Advertising Federation, American Marketing Association, Economics and Business Society, Pre Law Student Association, Society for African American Corporate Leaders, and the Society for Human Resource Management. These organizations sponsor social events and hold regular career meetings where well known business leaders discuss current issues and provide career advice. There is an Executive Lecture Series and a Total Quality Management Lecture Series available to all students.

COOPERATIVE EDUCATION

As a means of enabling qualified students to acquire valuable work experience in conjunction with their studies, NCSU cooperates with participating business firms to provide opportunities for work interspersed with studies. Students alternate academic semesters with work experience semesters. Co op offers students an opportunity to apply their education in a business setting, to earn money for support of their education, and to establish links for potential permanent employment. Further information may be obtained from the Office of Cooperative Education, 213 Peele Hall.

CAREER PLANNING AND PLACEMENT

The College of Management has an Office of Career Planning and Placement devoted to assisting Accounting, Business Management, and Economics majors with career related issues. Services include individual career counseling as well as workshops on resume writing, interviewing techniques, and on-campus recruiting. A wide-range of companies in all business areas recruit students actively on campus. The career planning and placement service also assists students in locating part-time jobs and internships.

GRADUATE STUDY

The Master of Science in Management is available with technical options in the Colleges of Engineering, Forestry, and Textiles. The Master of Economics and Doctor of Philosophy in Economics are both offered through the Economics Department.

ACCOUNTING

Nelson Hall

Professor C. J. Messere, Head of the Department

Alumni Distinguished Undergraduate Professor: C. V. Skender

KPMG Peat Marwick Professor: C. J. Messere

Professors: J. W. Bartley, K. B. Frazier, J. W. Rockness, P. F. Williams; Professor Emeritus: P. R. Windham, Associate Professors: R. L. Peace, G. J. Zuckerman; Assistant Professors: B. C. Branson, F. A. Buckless, A. Y. Chen, S. M. Comstock, K. A. Krawczyk, R. L. McClenny, J. L. Rodgers, R. B. Sawyers; Lecturers: E. R. Carraway, H. O. Griffin, K. C. Lawyer, G. A. Marsh, C. J. Skender.

The accounting program provides education and training to individuals who will pursue careers as professional accountants in business, government, industry or public accounting. The Department of Accounting currently offers a Bachelor of Arts degree in Accounting. In order to meet the demands of employment markets for more highly skilled accounting professionals and respond to the American Institute of Certified Public Accountants' mandated 150 hour education requirement by the year 2000, the Department of Accounting plans to initiate a fifth year Master of Accounting degree program in 1994.

OPPORTUNITIES

Accounting systems and the accountants who maintain them are absolutely essential to the functioning of business enterprises of all types and sizes; to government at all levels; and to nonprofit organizations. Many career opportunities are available to accounting graduates. Starting salaries are among the highest of all university graduates and potential earnings over a lifetime are excellent.

The accounting profession is organized into three major employment groups: (1) approximately 60 percent of accountants are employed in business entities, (2) another 10 percent work in nonbusiness entities, and (3) about 30 percent are in public practice. Public accountants offer auditing tax preparation and planning, and management consulting to individuals, businesses and other organizations on a fee basis. Management or industrial accountants design financial and cost accounting systems and provide their companies with financial management, financial analysis, planning and budgeting, product costing, and operational auditing. Governmental units and other not for profit entities have informational needs similar to private businesses. Accountants employed by such entities perform many of the same functions. Accountants in some governmental agencies, such as the SEC, IRS and FBI, serve the dual function of auditing and law enforcement.

Certified Public Accountants (CPAs), Certified Management Accountants (CMAs), Certified Internal Auditors (CIAs) and Certified Cost Analysts (CCAs) are individuals who, like doctors, dentists, and lawyers, are licensed to practice their profession. Such certifications are granted to those accountants who pass a qualifying examination and meet certain accounting experience and educational requirements.

Sitting for a professional licensing exam upon graduation and becoming "certified" is an important professional achievement. All NCSU accounting program graduates are eligible to sit for these professional exams. NCSU graduates regularly exceed both state and national pass rates on such professional exams.

SCHOLARSHIPS AND AWARDS

Approximately ten achievement awards sponsored by businesses and public accounting firms are made to outstanding juniors annually. A special accounting faculty fund supports similar awards for outstanding incoming freshmen each year.

BACHELOR OF ARTS IN ACCOUNTING

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 100 Intro Acctg Profess	1	ENG 112 Composition & Reading	3
ENG 111 Composition & Rhetoric	3	MA 114 Intro to Finite Math	3
FL 201 Intermed. For Lang	3	History Elective	3
MA 121 Elements of Calculus	4	Natural Science Elective	4
PE 100 Health & Phys. Fitness	1	Social Science Elective	3
History Elective	3	Physical Education Elective	1
	15		17
SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 200 Computer Acctg. Appl	1	ACC 220 Accounting II	3
ACC 210 Accounting I	3	ACC 310 Intermed. Fin. Acctg.	3
CSC 200 Intro. to Computers	3	BUS 350 Statistics	3
EC 201 Intro to Economics	3	COM 110 Public Speaking	3
Literature Survey Elective	3	or COM 146 Bus. Communication	3
Natural Science Elective	4	EC 301 Intermed. Microecon.	3
Physical Education Elective	1	or BUS 310 Manager. Econ.	3
	18	Literature Survey Elective	3
			18

JUNIOR YEAR

Fall Semester	Credits	Spring Semester	Credit
ACC 311 Intermed. Fin. ACC II	3	ACC 300 The Acctg. Profession	1
ACC 320 Managerial Cost	3	ACC 312 Intermed. Fin. ACC III	3
BUS 320 Financial Mgmt.	3	ACC 330 Intro. to Income Tax	3
EC 302 Intermed. Macroecon.	3	BUS 360 Marketing Methods	3
Social Science Elective	3	PHI 314 Issues in Bus. Ethics	3
Free Elective	3	Arts and Letters Elective	3
	18	Physical Education Elective	1
			17

SENIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
ACC 430 Advanced Income Tax	3	ACC 408 Commercial Law for Accountants	3
ACC 450 Auditing Fin. Info.	3	Departmental Elective	3
BUS 307 Business Law	3	Free Elective	3
Social Science Elective	3		9
Free Elective	3		
	15		

Minimum Hours Required for Graduation 127

¹In addition to NCSU and College of Management residency requirements, Accounting majors must complete at least six of the following seven courses in residency at NCSU: ACC 310, 311, 312, 320, 330, 450 and the departmental elective.

²Beyond the minimum requirements, students should plan (with the aid of their adviser) to complete additional course work to fulfill the requirements of their career objectives. Some of these courses may be required or suggested by various professional certifying boards. For example, CPA candidates should take ACC 460 and 490, CMA candidates should take ACC 420, and CIA candidates should take ACC 451. The additional coursework is flexible and depends upon the student's background and career orientation. Additional courses may be included in the curriculum category labeled "free" electives. In some cases, the additional course work will require either an extra semester or summer school attendance (i.e., in addition to the minimum 127 semester hours required for graduation).

³A "General Policies" statement for all College of Management majors is available in Nelson Hall 114. It serves as an addendum to the curriculum requirements and describes GPA requirements for graduation, residency requirements, suspension policy, required grades in specific courses, course repeat policy, etc.

MINOR IN ACCOUNTING

The Department of Accounting offers a minor in Accounting to any undergraduate degree student outside the College of Management. The Accounting minor is offered to students interested in gaining a basic knowledge of accounting and an understanding of how accounting information is used to make rational decisions by individuals, businesses, and society. The minor requires 15 hours of accounting courses and includes an introduction to financial, managerial, and tax accounting principles and practices. The minor is not intended to prepare students for a professional accounting career. Please consult the College of Management for specific information about admission and other requirements.

BUSINESS MANAGEMENT

Nelson Hall (Room 103)

Professor D. M. Holthausen, Head of the Department

Alumni Distinguished Undergraduate Professor: J. W. Wilson

Professors: S. G. Allen, R. L. Clark, E. Gerstner, J. D. Hess, D. M. Holthausen, C. P. Jones, D. K. Pearce, J. W. Wilson; Professors Emeriti: A. J. Bartley, D. R. Dixon. Associate Professors: A. Agrawal, D. L. Baumer, J. C. Dutton, E. A. McDermed, K. Mitchell, A. Padilla, J. C. Poindexter, Jr.; Assistant Professors: C. C. Bozarth, S. N. Chapman, K. S. Davis, S. K. Markham, Y. E. Tang; Assistant Professor Emeriti: O. G. Thompson; Lecturers: D. M. Brock, J. P. Huggard, J. P. Jeck, C. B. Kimbrough, A. D. Fisher; Associate Member of the Faculty: R. J. Bernhard (Industrial Engineering).

The Department of Business Management offers a Bachelor of Arts degree in Business Management which prepares students for careers in business, government or nonprofit

organizations and for graduate study in business, law or related fields. The curriculum stresses broad training in a variety of business fields such as accounting, finance, human resources, marketing, quantitative methods, and production within a well-rounded liberal arts education. A wide range of career opportunities are available in areas such as sales and marketing, retailing, banking and financial services, personnel and human resource management, and production and operations management.

BACHELOR OF ARTS IN BUSINESS MANAGEMENT

The Bachelor of Arts degree in Business Management includes 58 hours of humanities, natural and social sciences, mathematics, and physical education, 55 hours in the major, and 12 hours of free electives. Required courses in the major include accounting, economics, communications, business writing, legal and regulatory environment of business, computer science, finance, marketing, organizational behavior, quantitative methods (or operations management), and business strategy. Business management students also complete a three-course business concentration and choose two departmental electives.

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Comp. & Rhetoric	3	CSC 200 Intro. to Computers	3
FL 201 Intermed. For. Lang.	3	EC 201 Intro. to Economics	3
MA 121 Elements of Calculus	4	ENG 112 Comp. & Reading	3
Natural Science Elective	4	MA 114 Intro. to Finite Math	3
PE 100 Health & Phys. Fit.	1	Natural Science Elective	4
	15	Physical Education Elective	1
			17

SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 210 Accounting I	3	ACC 220 Accounting II	3
BUS 200 Microcomp. App. for Bus.	1	BUS 350 Econ. Bus. Stat. (EB 350)	3
EC 301 Intermed. Microecon.	3	EC 302 Intermed. Macroecon.	3
PSY 200 Intro. to Psychology	3	History Elective	3
History Elective	3	Literature Survey Course	3
Literature Survey Course	3	Physical Education Elective	1
Physical Education Elective	1		16
	17		

JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BUS 305 Law and Society	3	BUS 455 Quant. Methods (EC 425)	3
BUS 320 Financial Mgmt. (EC 320)	3	PHI 314 Issues in Business Ethics	3
BUS 330 (EC 326) or	3	Business Concentration	3
PSY 307 Org. Behavior	3	Communications Elective	3
BUS 360 Marketing Methods (EC 313)	3	Social Science Elective	3
ENG 332 Comm. for Bus. Mgt.	3		15
	15		

SENIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Arts and Letters Elective	3	BUS 480 Business Policy	3
Business Concentration	3	Business Concentration	3
Departmental Elective	3	Departmental Elective	3
Free Electives	6	Free Electives	6
	15		15

Minimum Hours Required for Graduation 125

MINOR IN BUSINESS MANAGEMENT

The Department of Business Management offers a minor in Business Management to all undergraduate students. The minor provides students with basic knowledge in important areas of business management. Courses in accounting, finance and marketing are required. Students elect two other courses to complete the 15 hour minor. Please consult the department for specific information about admission and other requirements.

ECONOMICS

Patterson Hall

Professor R. B. Palmquist, Department Head

University Distinguished Professor: V. K. Smith

Professors: S. G. Allen, R. L. Clark, E. W. Erickson, R. M. Fearn, D. Fisher, D. J. Flath, T. G. Grennes, A. R. Hall, D. N. Hyman, C. R. Knoeber, S. E. Margolis, D. K. Pearce, J. J. Seater, C. B. Turner, Adjunct Professor, J. B. Hunt, Jr.; Professor Emeritus: B. M. Olsen; Associate Professors: D. S. Ball, A. E. Headen, J. S. Lapp, M. B. McElroy, C. M. Newmark, W. N. Thurman, W. J. Wessels; Assistant Professor: L. A. Craig; Associate Member of the Faculty: D. A. Dickey (Statistics).

The Department of Economics offers Bachelor of Arts and Bachelor of Science degrees in Economics. Successful completion of an undergraduate degree in economics prepares a student for careers in business or government and for advanced education. Economics students can develop expertise in monetary policy and financial institutions, international trade and finance, labor and industrial relations, environmental and natural resource economics, government expenditures and taxation, economic history, and a variety of other fields. A degree in economics is attractive to employers because it provides a thorough understanding of our economic system and allows the flexibility to tailor your education to your career plans. An economics degree is also excellent preparation for a variety of graduate degrees as well as for professional degrees in business or law.

BACHELOR OF ARTS IN ECONOMICS

The Bachelor of Arts in Economics provides for a liberal arts oriented study of one of the most important of the social sciences. The major course work for the Bachelor of Arts in Economics consists of 12 semester hours of economic theory and 6 semester hours devoted to statistics and computer science. Additionally, students study at least 15 semester hours of advanced, applied economics. The degree program provides for substantial flexibility to allow students to tailor their studies to their particular interests and academic objectives. The degree requirements are currently being revised and students are strongly encouraged to consult with their faculty advisors to select courses which are consistent with current requirements. A sample schedule under the current curriculum is given below.

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
MA 121 Elements of Calculus	4	MA 114 Intro to Finite Math	3
FL 201 Intermed. For. Lang.	3	History Elective	3
History Elective	3	Natural Science Elective	3
PE 100 Health & Phys. Fitness	1	Social Science Elective	3
	14	Physical Education Elective	1
			17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EC 201 Introduction to Economics	3	CSC 200 Introduction to Computers	3
Literature Survey Course	3	EC 202 Econ. Problems & Issues	3
Natural Science Elective	4	Literature Survey Course	3
Philosophy Elective	3	Social Science Elective	3
Social Science Elective	3	Physical Education Elective	1
Physical Education Elective	1	Free Elective	3
	17		16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BUS 350 Econ./Bus. Stat. (EC 350)	3	EC 302 Intermed. Macroecon.	3
EC 301 Intermed. Microecon.	3	Departmental Electives	6
Arts and Letters Elective	3	Economics Electives	6
Departmental Elective	3		15
Free Elective	3		
	15		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Departmental Electives	6	Departmental Electives	6
Economics Electives	6	Economics Elective	3
Free Elective	3	Free Electives	6
	15		15

Minimum Hours Required for Graduation 124

BACHELOR OF SCIENCE IN ECONOMICS

The Bachelor of Science in Economics provides training in the analytical methods and the body of knowledge of economics. This program differs from the Bachelor of Arts by having less emphasis on the liberal arts and greater emphasis on mathematics and technical courses. The degree requirements are currently being revised and students are strongly encouraged to consult with their faculty advisors to select courses which are consistent with current requirements.

MINOR IN ECONOMICS

The minor in Economics is designed to acquaint students with an understanding of theory and methods of economics and to introduce them to the application of Economics to contemporary social issues. The minor in Economics is an excellent compliment to many fields of study in the University. To complete the minor in Economics students must take EC 201 (or ARE 212), EC 301, EC 302 and two additional economics courses for a total of 15 semester hours.

COLLEGE OF PHYSICAL AND MATHEMATICAL SCIENCES

Cox Hall (Rooms 113 122)

J. L. Whitten, *Dean*

R. D. Bereman, *Associate Dean for Academic Affairs*

R. E. Fornes, *Associate Dean for Research*

R. G. Savage, *Assistant Dean for Academic Affairs*

W. P. Hill, *Coordinator for African American Affairs*

The College of Physical and Mathematical Sciences offers students, whose interests lie in the basic as well as the applied science and mathematical areas, programs of study and research at both the graduate and undergraduate level that lead to many career opportunities. In addition, the College provides the core science and mathematical education support for the entire University. The College consists of five academic departments: Chemistry, Marine, Earth and Atmospheric Sciences, Mathematics, Physics, and Statistics. It jointly administers academic programs in Biochemistry, The Center for Research in Scientific Computing, The Institute of Statistics, the Natural Resources Research Center, the Precision Engineering Center, the Center for Advanced Electronic Materials Processing, the microelectronics research activities, and biotechnology research activities are also associated in part with the College.

Graduates of the College are recruited for technical and administrative positions in industrial research and development laboratories, universities and colleges, non profit research organizations and government agencies. A large percentage of the graduates undertake advanced study in medical or other professional schools as well as further study leading to the Master of Science and Doctor of Philosophy degrees.

The high school student who enjoys computers, mathematics, chemistry, geology, marine science, atmospheric science, or physics and who has an interest in natural phenomena and their fundamental descriptions, should consider the career opportunities in the physical and mathematical sciences. Students in the College consistently perform very well as undergraduates; approximately one-third of the students graduate with honors.

FACILITIES

Each department in the College utilizes a number of highly specialized research facilities. These range from highly specialized laboratories such as those in solid state physics or nuclear magnetic resonance spectroscopy to state-of-the-art instruments such as X-ray diffractometers and electron spin resonance spectrometers. These laboratories are routinely utilized by advanced undergraduates taking part in research programs. In addition, each department maintains up-to-date instructional and research computer laboratories and each has access to the CRAY YMP super computer in the Research Triangle Park. These facilities are utilized not only for graduate research but for undergraduate research and instruction. A detailed list of specialized equipment is available upon request for each department.

TUTORIAL AND AUDIO-VISUAL ASSISTANCE

Most of the departments in the College offer students some form of free tutorial assistance, and several departments provide facilities for students to use supplementary video taped or computer-assisted instructional materials on a voluntary basis.

CURRICULA

The College offers undergraduate programs of study leading to the Bachelor of Science degree with a major in chemistry, geology, mathematics, meteorology, natural resources, physics or statistics. We anticipate offering a new degree in Environmental Sciences in the near future. These curricula have similar freshman years, enabling a freshman to change, without loss of time, from one department to another in the College. In addition, the College offers programs of study leading to the Bachelor of Arts degree with a major in geology or chemistry. A one year general program (PMU) is offered to students who want to major in one of these curricula but have not yet made a decision. Minors are offered in geology, mathematics, meteorology, physics and statistics.

PREMEDICAL SCIENCES

Medical and dental schools as well as many other health-related professional schools have long regarded degree programs in the core physical and mathematical sciences as excellent "pre professional" curricula. Some professional schools prefer the in-depth knowledge gained by this route over those curricula which offer a cursory view of a variety of topics. For further details, contact Dr. Robert Bereman, Associate Dean for Academic Affairs.

SHORT COURSES AND INSTITUTES

Several short courses and specialized institutes are offered throughout the academic year and during the summer months in chemistry, geology, mathematics, physics, and statistics for high school and college faculty. For information contact the Associate Dean of the College.

In addition, certain regular courses may be taken for credit through correspondence or evening classes through the Division of Continuing Education in Raleigh, Charlotte, or the Greensboro Burlington-Winston-Salem area. For information write Adult Credit Programs and Summer Sessions, Box 7401, NCSU, Raleigh, N.C. 27695-7401.

SCHOLARS AND HONORS PROGRAMS

Exceptional students may be selected to participate in the University Scholars Program of the College of Physical and Mathematical Sciences. Enriched courses in chemistry, English, mathematics, and physics have been developed specifically for program participants. At the beginning of the junior year, promising students may select special courses, and begin to participate in undergraduate research and honors programs, for which they may receive some graduate credit toward the Master of Science degree during the senior year.

Well prepared students entering the College may seek advanced placement in biology, chemistry, computer science, foreign language, history, mathematics, or physics by passing qualifying examinations.

STUDENT ACTIVITIES

In addition to university wide extracurricular activities and honor organizations, the College of Physical and Mathematical Sciences has student chapters of the following professional and honor organizations: Society of Physics Students, Pi Mu Epsilon, the American Chemical Society, Mu Sigma Rho, American Meteorology Society, American Institute of Mining Engineers (Geology Club), and the nation's first chapter of the Society of African American Physical and Mathematical Scientists.

The College Student Council, composed of elected students from the College, sponsors and participates in a wide variety of technical and social activities.

GRADUATE STUDY

The Master of Science degree is available with a major in biomathematics; chemistry; marine, earth, and atmospheric sciences; mathematics; applied mathematics; statistics; and physics. The Master of Biomathematics, Master of Chemistry, and the Master of

Statistics are also offered. The Doctor of Philosophy degree is available in biomathematics; chemistry; marine, earth, and atmospheric sciences; mathematics; applied mathematics; statistics; and physics.

BIOCHEMISTRY

(See Agriculture and Life Sciences)

CHEMISTRY

Dabney Hall (Room 108) and Withers Hall

Professor J. G. Osteryoung, Head of the Department

Professor W. P. Tucker, Director of Undergraduate Studies

Professor R. J. Linderman, Director of Graduate Studies

Alumni Distinguished Undergraduate Professors: F. C. Hentz, Jr., W. P. Tucker

Professors: A. J. Banks (Director of General Chemistry), R. D. Bereman, L. H. Bowen, C. L. Bumgardner, H. H. Carmichael, D. L. Comins, F. W. Getzen, K. W. Hanck, F. C. Hentz, S. G. Levine, G. G. Long, M. L. Miles, A. F. Schreiner, E. O. Stejskal, G. H. Wahl, Jr. (Director of Organic Laboratories), M. H. Whangbo, J. L. Whitten; Research Professor: R. A. Osteryoung; Professors Emeriti: G. O. Doak, L. D. Freedman, Z. Z. Hugus, L. A. Jones, R. H. Loeppert, P. P. Sutton, R. C. White; Associate Professors: C. B. Boss, E. F. Bowden, T. C. Caves, A. F. Coots, Y. Ebisuzaki, M. G. Khaleedi, S. T. Purrington, W. L. Switzer, D. W. Wertz; Associate Professor Emeritus, T. M. Ward; Assistant Professors: C. R. Cornman, D. A. Schultz, H. H. Thorp, R. B. van Brossen; Assistant Professor Emeritus, W. R. Johnston; Instructor Emeritus: G. M. Oliver; Laboratory Supervisors: R. D. Beck, H. Graetz, G. L. Hennessey, J. C. Le, S. S. Sankar, G. Shaw, J. T. Sigvaldsen, P. Singh; Laboratory Demonstrator: M. L. Benevides; Teaching and Research Technician: D. E. Knight

Chemistry is the science dealing with the composition, structure, and properties of all substances and changes that they undergo. Chemists have contributed to the synthetic fiber industry, petroleum products and fuels, plastics, the food processing industry, nuclear energy, electronics, modern drugs and medicine. Today's chemists are concerned with the fundamental building blocks of all materials—atoms and molecules—leading to improvement of old materials, development of substitutes or new ones, and an understanding of our material environment.

OPPORTUNITIES

The chemical industry is the nation's largest manufacturing industry. Chemists comprise the largest proportion of scientists in the United States and future demand for chemists should continue to grow. A variety of jobs are open to the chemist: biochemistry and other biological areas, education, medicine, law, metallurgy, space science, oceanography, sales and management, pure research and development. Chemists are employed in every field based on modern technology; opportunities for chemists in the field of education are many and varied.

BACHELOR OF ARTS IN CHEMISTRY

The B.A. program offers a more flexible course of studies for students who may not plan to become professional chemists but who desire an interdisciplinary program with an emphasis on chemistry. The proper choice of electives will prepare the graduate for one of the following: medical, veterinary or dental school, work in chemical sales and management, teaching in secondary schools, work in environmental science, or graduate school in an allied science. Since the first three semesters are essentially identical to those of the B.S. program, students may enter the B.A. program either directly from high school or some later point after entering the University.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 General Chemistry II	3
CH 121 General Chemistry Lab I	1	CH 127 General Chemistry Lab II	1
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 141 Analytic Geometry & Calc I	4	MA 241 Analytic Geometry & Calc. II	4
PE 100 Health & Physical Fitness	1	PY 205 Physics for Eng. & Sci. I	4
PMS 100 Orientation to PAMS	1	Physical Education Elective	1
Humanities/Soc. Sci. Elec.	3		16
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 221 Organic Chemistry I	4	CH 223 Organic Chemistry II	4
PY 208 Physics for Eng. & Sci.	4	Humanities/Soc. Sci. Elective ¹	3
Humanities/Soc. Sci. Electives ¹	6	Science Elective	4
Physical Education Elective	1	Free Elective	3
	15	Physical Education Elective	1
			15

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 331 Introductory Physical Chemistry	4	CH 315 Quantitative Analysis	4
Humanities/Soc. Sci. Electives ¹	6	Advised Electives ²	3
Science Elective	4	Humanities/Soc. Sci. Elective ¹	6
Free Elective	3	Free Elective	3
	17		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 401 Systematic Inorganic Chem. I	2	BCH 451 Introductory Biochemistry	3
Advised Electives ²	8	Advised Electives ²	7
Humanities/Soc. Sci. Elective ¹	3	Humanities/Soc. Sci. Elective ¹	3
Free Elective	3	Free Elective	3
	16		16

Minimum hours required for graduation 127

Because of the inherent flexibility of the B.A. curriculum in chemistry, students entering into the program must work closely with their faculty adviser in selecting an area of concentration outside the major, based upon their career or postgraduate goals.

¹Thirty hours of humanities and social science courses are required with a minimum of 12 hours of humanities and 12 hours of social sciences. The remaining 6 hours may come from humanities or social science courses, including Multidisciplinary Studies and Arts Studies courses.

²Advised electives are designed to allow the students to concentrate in areas related to academic or career goals. The courses used to fulfill this requirement are selected after students consult with their faculty advisers.

³The University is currently modifying its "General Education Requirements" that must be met by all NCSU students. One of the changes to be implemented requires foreign language proficiency at the FL 102 level for graduation. This proficiency will be established by an examination administered by the Foreign Language Department or by successfully completing FL 102. Courses required to establish the foreign language proficiency cannot be used to meet graduation requirements. FL 201 or higher in the student's first language or any FL course in a second language can be used to satisfy graduation requirements.

⁴D grades are not accepted in the following courses: CH 101, CH 107, CH 221, CH 223, CH 315, CH 331; MA 141, PY 205, ENG 111, AND ENG 112.

BACHELOR OF SCIENCE IN CHEMISTRY

The curriculum, accredited by the American Chemical Society, includes a strong, broad background in mathematics, physics and the liberal arts. The basic areas of organic, physical, inorganic and analytical chemistry are stressed. Laboratory and classroom work develop the skills, knowledge and inquiring spirit necessary for a successful career in chemistry. The advised elective credits allow individual diversity at the junior and senior levels. Many undergraduates participate in current departmental research through part-time employment or research projects. The B.S. curriculum prepares the student to enter the job market directly as a chemist or to enter various professional schools or graduate schools in chemistry or an allied science. This route is also an excellent premedical program.

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 General Chemistry II	3
CH 121 General Chemistry Lab I	1	CH 127 General Chemistry Lab II	1
CH 106 Computer Appl. Chemistry I	1	CH 108 Computer Appl. Chemistry II	1
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 141 Analytic Geometry & Calc I	4	MA 241 Analytic Geometry & Calc. II	4
PE 100 Health & Physical Fitness	1	PY 206 Physics for Eng. & Sci. I	4
PMS 100 Orientation to PAMS	1	Physical Education Elective	1
Humanities/Soc. Sci. Elective ¹	3		17
	17		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 221 Organic Chemistry I	4	CH 211 Analytical Chemistry I	3
MA 242 Analytic Geometry & Calc. III	4	CH 212 Analytical Chemistry I Lab	1
PY 208 Physics for Eng. & Sci. II	4	CH 223 Organic Chemistry II	4
Humanities/Soc. Sci. Elective ¹	3	MA 341 Differential Equations I	3
Physical Education Elective	1	English Elective (Literature)	3
	16	Humanities/Soc. Sci. Elective ¹	3
			17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 401 Syst. Inorganic Chemistry I	2	CH 403 Syst. Inorganic Chemistry II	3
CH 402 Inorganic Chemistry Lab	1	CH 433 Physical Chemistry II	3
CH 428 Qualitative Organic Analysis	3	CH 434 Physical Chemistry Lab	3
CH 431 Physical Chemistry I	3	FL 102 Elementary Language II ²	3
FL 101 Elementary Language I ²	3	Advised Elective ³	3
Advised Elective ²	3	Writing/Communications Elective	3
	15		18

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 415 Analytical Chemistry II	3	Advised Elective ³	3
CH 416 Analytical Chemistry Lab	1	Humanities/Soc. Sci. Elective ¹	3
CH 435 Intro. Quantum Chemistry	3	Physical Education Elective	1
PY 407 Intro. Modern Physics	3	Free Electives	7
Advised Elective ²	3		14
Humanities/Soc. Sci. Elective ¹	3		
Free Elective	3	Minimum hours required for graduation	130
	16		

¹These credits should be distributed approximately equally between the humanities (fine arts, history, literature, languages, philosophy, and religion) and the social sciences (anthropology, economics and business, political science, psychology, and sociology).

²Advised electives are designed to allow students to concentrate in an area or field of their choice. Courses used to fulfill this requirement are selected by students after consultation with their advisers or the Coordinator of Advising.

³The University is currently modifying its "General Education Requirements" that must be met by all NCSU students. One of the changes to be implemented requires foreign language proficiency at the FL 102 level for graduation. This proficiency will be established by an examination administered by the Foreign Language Department or by successfully completing FL 102.

Courses required to establish the foreign language proficiency cannot be used to meet graduation requirements. FL 201 or higher in the student's first language or any FL course in a second language can be used to satisfy graduation requirements.

⁴D grades are not accepted in the following courses: CH 101, CH 107, CH 211, CH 221, CH 223, CH 431, CH 433, ENG 111, ENG 112, MA 141, MA 241, MA 242, PY 206, PY 208.

MARINE, EARTH AND ATMOSPHERIC SCIENCES

Jordan Hall (Room 1125)

Professor L. J. Pietrafesa, *Head of Department*

Professor V. V. Cavaroc, *Department Undergraduate Coordinator*

Associate Professor E. F. Stoddard, *Geology Undergraduate Program*

Associate Professor A. J. Riordan, *Meteorology Undergraduate Program*

University Distinguished Scholar: T. F. Malone

Alumni Distinguished Undergraduate Professor: V. V. Cavaroc, Jr.

Professors: S. P. S. Arva, V. V. Cavaroc, Jr., J. M. Davis, D. J. DeMaster, R. V. Fodor, G. S. Janowitz, D. L. Kamykowski, L. J. Pietrafesa, S. Raman, V. K. Savena, T. G. Wolcott. *Visiting Professors:* T. S. Hopkins, C. S. Ramage. *Adjunct Professors:* A. H. Illies, B. V. Madala, J. M. Teissier, W. H. Snyder. *Professors Emeriti:* C. E. Anderson, H. S. Brown, L. J. Langfelder, C. J. Leath, J. M. Parker III, W. J. Saucier, C. W. Welby. *Associate Professors:* M. G. Bevis, N. E. Blair, S. Businger, M. M. Kimberley, C. E. Knowles, J. M. Morrison, A. J. Riordan, F. H. M. Semazzi, W. J. Showers, E. F. Stoddard, G. F. Watson. *Resident Associate Professors:* Viney Anaja. *Visiting Associate Professors:* M. L. Kaplan, C. J. Nappo, D. L. Wolcott. *Adjunct Associate Professors:* S. Chang, M. DeMaria, L. A. Levin. *Assistant Professors:* D. G. Evans, J. P. Hilbard, E. L. Leithold, Y. L. Lin, P. T. Shaw, S. W. Snyder. *Visiting Assistant Professors:* F. H. Proctor, L. Xue. *Adjunct Assistant Professors:* D. E. Checkley, T. B. Curtin. *University Distinguished Scholar:* T. F. Malone. *Senior Researcher:* R. Braham.

The Department of Marine, Earth and Atmospheric Sciences provides education and training in the three complementary disciplines of the earth's physical environment. The striking development in the sciences in recent years is the awareness of the interconnectedness of planetary system science. We are becoming increasingly cognizant of the couplings of ocean to atmosphere to land. Courses, curricula, and research programs in the department consequently deal with many aspects of two very important human concerns: environmental sciences and natural resources. The department awards the B.A. degree in geology; the B.S. degree in geology with options either in traditional geology or in geophysics; and the B.S. degree in meteorology. In addition, concentrations in marine and coastal resources and geological resources are offered through the Natural Resources Curriculum. (Consult the *Graduate Catalog* for information pertaining to graduate degrees offered.)

Geology Geophysics (Earth Science) is the study of the solid earth. It can be subdivided into the interrelated areas of: the earth's influence upon humanity (hydrogeology, surficial processes, quantitative geomorphology, engineering, petroleum and economic and environmental geology); rocks and minerals (mineralogy, petrology, and ore deposits); nature and behavior of earth materials (structural geology, geophysics, geochemistry, and geomorphology); earth history (historical geology, stratigraphy, tectonics and paleontology). Instruction within the geology degree programs includes course work in each of these areas. The geophysics option includes a core of basic geology courses, but in addition provides a thorough grounding in geophysics and related sciences. This program involves more coursework in physics, mathematics and computer science than does the traditional geology B.S. and applies these quantitative sciences to an understanding of the hidden earth. This is accomplished through the measurement and interpretation of earth's physical properties (e.g. magnetic, electric, gravity, seismic) at all scales.

Geologists and geophysicists apply scientific techniques to solve those problems in nature that will result in a better understanding and utilization of our environment and natural resources. Geologic and geophysical principles are used (1) to discover, evaluate, develop and conserve our natural resources (fossil fuels, minerals, water and metals), (2) to find solutions to problems related to global climate change, sea level rise, the disposal of liquid and solid wastes, (3) in determining the geologic settings for highways, dams, tunnels, and power plants and (4) to help prevent or alleviate the consequences of natural disasters such as earthquakes, floods, volcanic eruptions, dam failures, and highway collapse.

Meteorology (Atmospheric Science) is the study of all aspects of the behavior and phenomena of the atmosphere, including its interactions with earth's land and sea surfaces

and with the solar atmosphere. Its objective is to apply an understanding of the atmosphere to the benefit of humanity.

Few activities on earth are unaffected by the natural conditions and processes of our atmospheric environment. The most familiar purpose of meteorology is in providing weather reports, warning, and forecasts which are essential to aviation, shipping, agriculture, power utilization, outdoor recreation and to the protection of humans from weather hazards and damage. Meteorology is applied to the understanding and alleviation of other environmental concerns such as air pollution, acid rain, and weather modification. The concern about environmental quality has led to expanded efforts in atmospheric modeling and monitoring in research applied to industrial operations, environmental planning and governmental regulation. Basic subdivisions in the field of meteorology are synoptic and dynamic, boundary layer, air pollution, and agricultural meteorology; cloud and aerosol physics; and climatology.

Oceanography (Marine Science) encompasses the studies of the chemistry, geology, physics and biology of the marine environment and relationships with the earth, atmosphere and biosphere. Thus oceanography is an interdisciplinary science which integrates the basic fundamental principles of biology, chemistry, geology, geophysics, mathematics, meteorology, physics and statistics. In our solar system, planet Earth is the oblate blue gem, so characterized because more than seventy-five percent of its surface is covered by oceans, estuaries and lakes; water bodies which control the Earth's climate. Faculty and students study topics ranging from coastal and estuarine processes to the interaction of the ocean and atmosphere to the role of the ocean in climate. Specific courses and areas of concentration with focus on marine science are offered within the basic disciplines of atmospheric, biological, chemical, geological, and physics based sciences.

OPPORTUNITIES

The Department has access to a wide variety of computer services. These range from Department facilities (discussed below), to college and University facilities, and the North Carolina Supercomputing Facility. The University and State operate a state-of-the-art computer network that allows access to computer resources within the University, State and nationally. In addition, the State operates CONCERT, Communications for North Carolina Education, Research and Technology, that links universities, research institutions and graduate centers throughout North Carolina via a high speed computer network and interactive video networks.

The Department has access to the Air and Energy Engineering Research Laboratory of the Environmental Protection Administration which includes a large flow visualization laboratory.

The Department offers extensive research activities in ocean sciences. It is a member of the Duke/UNC Oceanographic Consortium, which operates the R V Cape Hatteras, a 135 ft. oceanographic research vessel; a member of the Cooperative Institute of Fisheries Oceanography, a joint venture of the National Marine Fisheries Service of the National Oceanographic and Atmospheric Administration and a number of Universities within the State; and offers a cooperative degree program with the University of North Carolina at Wilmington. Through these activities the Department has access to outstanding coastal marine facilities for teaching and research. Current research activities in the Department are worldwide in scope. Researchers and their students are currently working on activities that range from regional severe storm research and coastal zone studies to global climate studies. These activities take researchers to all six continents, including Antarctica, and to all of the oceans.

Problems involving energy and mineral resources and the environment are complex. Geologists and geophysicists are currently employed by environmental and geotechnical consulting firms, oil and coal companies, mining and quarrying concerns, mineral exploration companies, construction firms, cement companies, and railroads; coastal and forest service agencies; schools, colleges, museums and research institutions; and city, state and federal agencies (e.g. the Geological Survey).

Meteorological and oceanographic services are provided by federal government agencies, primarily the National Oceanic and Atmospheric Administration, the Departments of

Defense and Energy, the National Aeronautics and Space Administration and the Environmental Protection Agency. This work may involve atmospheric and oceanic sensing and measurement, including the use of satellites, ships and aircraft data analysis and computation; weather forecasting, and guidance service to aeronautics, defense and public safety agencies, agriculture, forestry, hydrology, recreation and public health. Meteorologists are involved in environmental planning and regulation at the state and local levels. Power generation and fuel transmission industries, engineering firms, environmental consulting firms, insurance companies, major retailing businesses, as well as schools, colleges and research institutions employ meteorologists because of recognition of the involvement of the atmosphere in their activities.

FACILITIES

The Department of Marine, Earth and Atmospheric Sciences maintains an extensive inventory of both laboratory and field research equipment and facilities. In addition the RV Cape Hatteras, specialized equipment in the department includes an X-ray fluorescence spectrometer, an automated X ray diffractometer, neutron activation analysis equipment, geophysics instruments; (e.g., gravimeter, magnetometer, and seismic reflection equipment), radioisotope and stable isotope analytical equipment, and a phytotron. Some of the specialized laboratories in the department include Electron Microprobe Laboratory; X Ray Diffractometer Laboratory; Sedimentology Laboratory (microcomputer controlled grain size analysis); Stable Isotope Laboratory; High Precision Liquid Chromatography Laboratory; Motion Analysis Laboratory; Satellite Oceanography and Image Analysis Laboratory; Weather Analysis and Forecasting Laboratory for research and teaching; Man Interactive Data Acquisition System for experiments in severe storm forecasting regional weather forecasting; Undergraduate Computer Teaching Facility; Weather Observatory including weather facsimile receiving capability and a weather balloon launch facility; Department Computer and Modeling Facility, including a Digital Equipment Corporation VAX3500, and a IBM RS6000/530 Computer Server, a wide assortment of computer graphics devices and remote terminals and print services; Physical Oceanographic Research Laboratory, including a large variety of equipment to monitor the oceans motion and composition; Planetary Boundary-Layer Laboratory, including a large variety of instrumentation for monitoring physical processes at the land-air and sea-air interface.

CURRICULA IN MARINE, EARTH AND ATMOSPHERIC SCIENCES

The B.A. and B.S. degree programs in geology require similar geology courses, but differ in their content of social-humanities, mathematics, and collateral physical sciences. The B.A. program is designed to be similar to a B.S. degree in geology obtained from other universities, while the B.S. program is more technically oriented, and similar to other curricula in the physical sciences at NCSU. The B.S. degree program in meteorology also follows the pattern of physical sciences curricula. Marine science tracks follow the patterns of the basic curricula in respective areas of concentration.

BACHELOR OF ARTS IN GEOLOGY (GYA)

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3	CH 101 General Chemistry I	3
MA 131 Calculus A	4	CH 121 Gen. Chem. I Lab	1
MEA 101 Geology I: Physical	3	ENG 112 Composition and Reading	3
MEA 110 Geology I Lab	1	MEA 102 Geology II: Historical	3
PE 100 Health & Physical Fitness	1	MEA 111 Geology II Lab	1
PMS 100 Orientation to PAMS	1	Humanities Soc. Sci. Elective ¹	3
Humanities Soc. Sci. Elective ¹	3	Physical Education Elective	1
	16		15

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 200 Intro. Computers & Use ³	3	CH 107 General Chemistry II	3
MEA 330 Crystallogr. & Mineralogy	4	CH 127 Gen. Chem. II Lab	1
MEA 331 Optical Mineralogy	2	MEA 440 Igneous & Meta. Petrol.	4
Humanities/Soc. Sci. Elective ¹	3	Humanities/Soc. Sci. Elective ¹	3
Math/Statistics Option ²	3	Free Elective	3
Physical Education Elective	1	Physical Education Elective	1
	<u>16</u>		<u>15</u>

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 333 Comm. for Sci. & Resear. ⁴	3	COM 110 Speech	3
MEA 450 Sediment Pet. & Strat.	4	MEA 451 Structural Geology	4
PY 211 College Physics I	4	Earth Science Elective ⁵	3
Humanities/Soc. Sci. Elective ¹	3	Humanities/Soc. Sci. Elective ¹	3
Free Elective	3	Science Option ⁶	4
	<u>17</u>		<u>17</u>

SUMMER SESSION

MEA 465, 466 Geologic Field Camp I, II 6

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Advised Elective ⁴	3	MEA 491 Senior Seminar	2
Earth Science Elective ⁵	3	Advised Elective ⁴	3
Humanities/Soc. Sci. Elective ¹	3	Earth Science Elective ⁵	3
Phil./Hist. of Sci. Option ⁷	3	Humanities/Soc. Sci. Elective ¹	3
Free Elective	3	Humanities/Soc. Sci. Elective ¹	3
	<u>15</u>		<u>14</u>

Minimum hours required for graduation 131

¹A course in each of at least three Humanities (e.g. Fine Arts, History, Literature, Language, Philosophy, Religion) and in each of at least three Social Sciences (e.g. Anthropology, Economics, Political Science, Psychology, Sociology). At least nine hours must come from courses beyond the introductory level.

²One of the following: MA 231; ST 311; MA 114.

³The following may be substituted for CSC 200: a) E 115 plus CSC 110; b) E 115 plus CSC 110.

⁴ENG 331 or ENG 332 may be substituted for ENG 333.

⁵Earth Science Electives are above the 300 level. Select in consultation with advisor.

⁶One of the following: PY 212; BS 100; BO 200.

⁷One of the following: PHI 322 and 340; HI 321, 322, 341, 480, 481, and 482; MDS 301, 302, and 303.

⁸Advised Electives may be in geology or in a supporting field. Select in consultation with advisor.

BACHELOR OF SCIENCE IN GEOLOGY (GYS)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 General Chemistry II	3
CH 121 Gen. Chem. I Lab	1	CH 127 Gen. Chem. II Lab	1
ENG 111 Composition & Rhetoric	3	ENG 112 Composition and Reading	3
MA 141 Calculus I	4	MA 241 Calculus II	4
MEA 101 Geology I: Physical	3	MEA 102 Geology II: Historical	3
MEA 110 Geology I Lab	1	MEA 111 Geology II Lab	1
PMS 100 Orientation to PAMS	1	Physical Education Elective	1
PE 100 Health & Physical Fitness	1		
	<u>17</u>		<u>16</u>

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 242 Calculus III	4	MEA 440 Igneous & Meta. Petrol.	4
MEA 330 Crystallogr. & Mineral.	4	PY 205 Physics Engrs. & Scien. I	4
MEA 331 Optical Mineral.	2	Social Science Elective	3
Computer Science Option ¹	3-4	Statistical Science Option ²	3
Science Elective	3	Physical Education Elective	1
Physical Education Elective	1		
	<u>17-18</u>		<u>15</u>

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 333 Comm. for Sci. & Resear. ³	3	COM 110 Speech	3
MEA 450 Sediment Pet. & Strat.	4	MEA 451 Structural Geology	4
PY 208 Physics Engrns. & Scien. II	4	Math/Science Option ⁴	3-4
Humanities Elective	3	Philosophy/History Sci. Option ⁵	3
Free Elective	3	Free Elective	3
<u>17</u>		<u>16-17</u>	

SUMMER SESSION

MEA 465, 466	Geologic Field Camp I, II	6
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SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MEA 468 Invert. Paleo. & Biostrat.	4	MEA 491 Senior Seminar	2
Earth Science Elective ⁶	3	Earth Science Elective ⁶	3
Soc. Sci./Hum. Elective	3	Soc. Sci./Hum. Elective	3
Technical Elective A ⁷	3-4	Technical Elective B ⁷	3
Free Elective	3	Free Elective	3
<u>16-17</u>		<u>14</u>	

Minimum hours required for graduation 134

³Computer Science Option to be selected from among: a) E 115 plus CSC 110; b) E 115 plus CSC 112; and c) CSC 200.

⁵Statistical Science Option to be selected from among ST 301, ST 361, and ST 371.

⁶ENG 331 or ENG 332 may be substituted for ENG 333.

⁴Math/Science Option to be selected from among CH 220, 221, 315, 331, 431; MA 305, 341, 421; PY 407; MAE 301; CSC 302; CE 213; ST 302.

⁵One of the following: PHI 322 and 340; HI 321, 322, 341, 480, 481, and 482; MDS 301, 302, and 303.

⁶Earth Science Electives are above the 300 level.

⁷Technical Elective is a paired two-course sequence in a related field. Examples include: Physics (e.g. PY 411 and 412; PY 407 and 441); Astronomy (e.g. PY 223 and 240); Biological Sciences (e.g. BO 200 and 360; BS 100 and ZO 220); Civil Engineering (e.g. CE 214 and 215; CE 201 and 219); Soil Science (e.g. SSC 200 and SSC 361); Economics (e.g. EC 201 and 202); Anthropology (e.g. ANT 251 and 253); Computer Science (e.g. CSC 201 and 202); Chemistry (e.g. CH 331 and 401; CH 223 and 428, provided CH 221 has been taken to fulfill the Math/Science Option requirement); Mathematics (e.g. MA 225 and 403); Microbiology (e.g. BS 100 and MB 401, provided CH 220 has been taken to fill the Math/Science Option; Statistics (e.g. ST 302 and 432 or ST 372 and 432, provided ST 301 or ST 371 has been used to fulfill the Statistical Science Option requirement); Meteorology (e.g. MEA 130 and 311); Marine Science (e.g. MEA 200 plus any one of MEA 220, 510, 560, or 571). Courses used to fulfill other requirements may not be applied to the Technical Elective requirement.

MINOR IN GEOLOGY

The Department of Marine, Earth and Atmospheric Sciences offers a Minor in Geology to majors in any field except geology (GYA, GYS, and GPY). Admission to the program requires a grade of C or better in MEA 101 and MEA 110. Successful completion of the program requires a grade of C or better in at least 14 hours of geology courses beyond the first semester including at least two lab courses. Contact the department (515-7776) for added information and consultation with a minor advisor.

GEOPHYSICS OPTION, BACHELOR OF SCIENCE IN GEOLOGY (GPY)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Chem. Principles	3
CH 121 Gen. Chem. I Lab	1	E 115 Intro. to Comput. Envir.	1
ENG 111 Composition & Rhetoric	3	ENG 112 Composition and Reading	3
MA 141 Calculus I	4	MA 241 Calculus II	4
MEA 101 Geology I: Physical	3	PY 201 University Physics II	4
MEA 110 Geology I Lab	1	Physical Education Elective	1
PE 100 Health & Physical Fitness	1		
PMS 100 Orientation to PAMS	1		
<u>17</u>		<u>16</u>	

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 112 Intro. Comp.—FORTRAN	3	CSC 302 Numerical Methods	3
MA 242 Calculus III	4	MA 341 Differential Equations	3
MEA 329 Elem. of Cryst. & Min.	2	MEA 439 Elem. of Ign. & Meta. Petrol.	3
PY 202 University Physics II ¹	4	PY 203 University Physics III ¹	4
Social Science Elective	3	Social Science Elective	3
Physical Education Elective	1	Physical Education Elective	1
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 401 Differential Eqns. II	3	MEA 451 Structural Geology	4
MEA 450 Sediment Pet. & Strat.	4	ST 361 Intro. Statistics for Engrs.	3
MEA 470 Intro. Geophysics	3	Humanities Elective	3
PY 411 Mechanics I	3	Earth Science Elective ²	3
Humanities Elective	3	Free Elective	3
	16		16

SUMMER SESSION

MEA 475 Geophysical Field Methods	2
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SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MEA 471 Exploration Geophysics	3	MEA 476 Seismic Exploration	3
PY 414 Electricity & Magnetism I	3	Earth Science Elective ²	3
Geophysics Elective ³	3	Soc. Sci./Hum. Elective	3
Soc. Sci./Hum. Elective	3	Technical Elective ⁴	3
Free Elective	3	Free Elective	3
	15		15

Minimum hours required for graduation 131

¹Students transferring into the program may substitute the sequence PY 205, 208, 407 for PY 201, 202, 203

²Recommended that GPY students include MEA 491

³Geophysics elective to be chosen from MEA 415, 461, and 523

⁴Technical elective constitutes a minor field of emphasis. Among those recommended are Physics (PY 412, 413, 415), and Math (MA 405, 427-428, 501)

BACHELOR OF SCIENCE IN METEOROLOGY (MY)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Chem. Principles & Applic.	3
CH 121 Gen. Chem. I Lab	1	ENG 112 Composition and Reading	3
ENG 111 Composition & Rhetoric	3	MA 241 Calculus II	4
MA 141 Calculus I	4	PY 206 Physics Engrs. and Scien. I	4
PMS 100 Orientation to PAMS	1	Physical Education Elective	1
Social Science Elective	3		
PE 100 Health & Physical Fitness	1		
	16		15

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
E 115 Intro. Comput. Environ.	1	CSC 112 Intro. Comput.—FORTRAN	3
MA 242 Calculus III	4	MA 341 Differential Eqns. I	3
MEA 311 Physical Climatology	3	MEA 312 Physical Meteorology	3
MEA 313 Meteorology Lab I	1	MEA 314 Meteorology Lab II	1
PY 208 Physics Engrs. and Scien. II	4	Approved Elective ¹	3
Social Science Elective	3	Humanities Elective	3
Physical Education Elective	1	Physical Education Elective	1
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MEA 421 Atmospheric Dynamics I	4	MEA 405 Climatol. Data Analysis	3
ST 361 Intro. Statistics for Engrs.	3	MEA 422 Atmospheric Dynamics II	4
Approved Elective ³	3	MEA 412 Atmospheric Physics	3
Communicative Arts ³	3	Communicative Arts ³	3
Geophysical Science Elective ²	3	Free Elective	3
	16		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MEA 443 Weather Anly. & Fesg. I	3	Approved Elective ⁴	3
MEA 455 Micrometeorology	3	Approved Elective ³	3
Approved Elective ³	3	Meteorology Technical Elective ⁵	3
Humanities Elective ¹	3	Soc. Sci./Hum. Elective	3
Soc. Sci./Hum. Elective	3	Free Elective	3
Free Elective	3		15
	18		

Minimum hours required for graduation 130

¹Advanced transfer students are permitted to substitute mathematics, science, or engineering credits for second semester chemistry course.

²Geophysical Science Elective is selected from among MEA 101-110, MEA 200, PY 223, SSC 200, and CE 200.

³Two courses in a foreign language, or one course each in speech and technical writing (but see note at 4 below)

⁴If the foreign language option is selected to fulfill the Communicative Arts requirement, then one Humanities Elective may be replaced with a Free Elective.

⁵Approved Electives constitute a minor field of emphasis consisting of at least 15 credit hours in a single discipline or related disciplines. These include, but are not limited to: biometeorology, chemistry, computer science, environmental quality, geology geophysics, hydrology, mathematics, physics, physical oceanography, statistics; several areas of engineering, agriculture, forestry; science education; weather communication. Students should investigate to see if their Approved Elective sequence also satisfies the requirements of an official Minor program.

⁶Meteorology Technical Elective: MEA 444, Weather Analysis and Forecasting II; or MEA 556, Air Pollution Meteorology.

MINOR IN METEOROLOGY

The Department of Marine, Earth and Atmospheric Sciences offers a Minor in Meteorology to majors in any field except meteorology. Admission to the program requires a grade of C or better in at least 15 hours of meteorology at the 300 level or above. These hours must include courses MEA 421 and MEA 422. Other courses taken should be selected in consultation with meteorology faculty. Contact the department for information (515-7776).

NATURAL RESOURCES CURRICULUM, GEOLOGICAL RESOURCES CONCENTRATION

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CPR 134 Computers in Nat. Res.	1	CH 101 General Chemistry I	3
ENG 111 Composition & Rhetoric	3	CH 121 Gen. Chemistry I Lab	1
MA 131 Anly. Geom. Calculus I	4	ENG 112 Composition and Reading	3
MEA 101 Geology I: Physical	3	MA 231 Anly. Geom. Calculus II	3
MEA 110 Geology I Lab	1	MEA 102 Geology II: Historical	3
NR 100 Intro. to Natural Resources	2	MEA 111 Geology II Lab	1
PE 100 Health & Physical Fitness	1	PE 253 Orienteering	1
	15		15

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 General Biology	4	ARE 336 Intro. Res. & Env. Econ.	3
CH 107 Principles of Chemistry	3	BO 200 Plant Life	4
CH 127 Principles Chem. Lab	1	MEA 410 Intro. Geologic Materials	4
EC 201 Microeconomics	3	ST 311 Introduction to Statistics	3
Foreign Language ¹	3	Free Elective	3
	14		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MEA 130 135 Intr. Weath. & Clim.	4	COM 110 Public Speaking	3
PY 211 College Physics I	4	MEA 200 Intro. Oceanography	3
Philos., Relig., or Fine Arts Elective	3	MEA 415 Geology Econ. Deposits	3
Political Science ¹	3	PS 336 Global Environ. Politics	3
Technical Writing ²	3	SSC 200 Soil Science	4
	17		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BO (ZO) 360 Intro. Ecology	3	NR 400 Management Nat. Res.	4
BO (ZO) 365 Ecology Lab	1	Applied Geology Elective A*	3.4
MEA 416 Geol. Fossil Fuel Depos.	3	Applied Geology Elective B ³	3
SSC 361 Non-agric. Land Use	3	History Literature Elective	3
History Literature Elective	3		13-14
	13		

Minimum hours required for graduation 120

¹Any at an intermediate level (FL-201)

²ENG 331, 332, or 333

³PS 201 or PS 202

*MEA 451 or MEA 481

*MEA 461, 465, 471, or 565

NATURAL RESOURCES CURRICULUM, MARINE & COASTAL RESOURCES CONCENTRATION

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CFR 134 Computers in Natl. Res.	1	BS 100 General Biology	4
ENG 111 Comp. & Rhetoric	3	ENG 112 Composition & Reading	3
MA 131 Anly. Geom. & Cal.	4	MA 231 Anly. Geom. & Cal.	3
MEA 101 Geology I: Physical	3	MEA 130 Intro. to Wea. & Clim.	3
MEA 110 Geology I Lab	1	MEA 135 Intro. to Wea. & Glob. Lab	1
NR 100 Intro. to Natl. Res.	2	*MEA 140 Natl. Haz. & Global Change or	
PE 100 Health & Physical Fitness	1	*MDS 220 Oceans Frontiers or	
	15	*MEA 102 Historical Geology	3
			17

*Choose only one of the three courses listed

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chem. I w Lab	4	CH 107 General Chem. II w Lab	4
MEA 200 Intro. to Oceanography	3	EC 201 Microeconomics	3
MEA 210 Intro. Ocean Lab	1	MEA 220 Marine Biology	3
PS 201 Intro. to American Govt. or		MEA 250 Intro. Coastal Environ.	3
PS 202 State and Local Env.	3	MEA 251 Intro. Coastal Environ. Lab	1
ZO 201 General Zoology	4	ST 311 Intro. to Statistics	3
	15		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BO 360 Intro. to Ecology	3	MEA 469 Coastal Benthic. Ecology	3
BO 365 Ecology Lab	1	PY 208 Physics Engrs. & Sci. II w Lab	4
BO/MEA 340 Ecol. Coastal Wetlands	3	SC 200 Soil Science	4
ENG 333 Comm. for Sci. & Res.	3	History Literature Elective	3
PY 205 Physics Engrs. & Sci. I w Lab	4		14
Soc. Sci. Hum. Elective	3		
	17		

SUMMER SESSION

MEA 460 Coastal Processes	4
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SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
COM 110 Public Speaking	3	ARE/EC 336 Intro. Res. & Env. Econ.	3
FW 420 Fishery Science	3	MEA 480 Scientific Iss. Coast. Res.	3
MEA 420 Marine Geochemistry	3	NR 400 Management Natural Res.	4
PS 336 Global Environ. Politics	3	PE 253 Orienteering	1
Phil., Rel., or Fine Arts Elective	3	Soc. Sci./Hum. Elective	3
	15		14

Minimum hours required for graduation. 128

MATHEMATICS

Harrelson Hall (Room 360)

Professor R. H. Martin, Jr., Head of the Department

Professor J. A. Marlin, Associate Head of the Department and Scheduling Officer

Associate Professor D. E. Garoutte, Associate Head of the Department and Director of Undergraduate Instruction

Associate Professor R. T. Ramsay, Director of Undergraduate Programs

Professor J. E. Franke, Director of Summer School

Alumni Distinguished Undergraduate Professor: J. M. A. Danby

Professors: H. T. Banks, J. W. Bishir, E. E. Burniston, S. L. Campbell, R. E. Chandler, E. N. Chukwu, L. O. Chung, J. M. A. Danby, J. C. Dunn, M. J. Evans, A. Fauntleroy, R. O. Fulp, R. E. Hartwig, C. T. Kelley, K. Koh, J. R. Kolb, J. Luh, J. A. Marlin, L. B. Martin, R. H. Martin, C. D. Meyer, C. V. Pao, E. L. Peterson, M. S. Putcha, H. Sagan, S. Schechter, J. F. Selgrade, M. Shearer, C. E. Stewart, M. F. Singer, E. L. Sitsainger, R. E. White. *Adjunct Professor:* R. J. Plemmons. *Professors Emeriti:* J. Levine, N. J. Rose. *Associate Professors:* M. T. Chu, J. D. Cohen, G. D. Faulkner, J. E. Franke, D. E. Garoutte, K. Ito, T. J. Lada, D. M. Latch, K. Misra, L. K. Norris, L. B. Page, R. T. Ramsay, J. Rodriguez, R. G. Savage, F. H. H. Semazzi, R. Silber, J. W. Silverstien, D. F. Ullrich, W. M. Waters. *Assistant Professors:* H. J. Charlton, B. Fitzpatrick, J. Garzaizar, D. J. Hansen, A. Helminck, P. Hitzzenko, A. Kheyfets, X.-B. Lin, W. R. McKinney, S. O. Paur, J. S. Seroggs, F. H. H. Semazzi, H. T. Tran; *Assistant Professor Emeritus:* C. F. Lewis; *Lecturer:* M. S. McCollum

The undergraduate major in mathematics provides a core of basic mathematics courses along with flexible choices of electives which permit both a well-rounded education and preparation for math-related careers. Because of the current employment market (for both baccalaureate and graduate students), students are advised to give serious consideration to the applied mathematics option.

Career objectives can be directed toward employment in math-related jobs in business, industry, or government, teaching at the secondary school level, or graduate study in mathematics and/or related areas.

The Mathematics Department operates a Multi Media Center which incorporates an Audio Visual Center, Tutorial Room, Undergraduate Mathematics Computer Lab and an IBM Computer Classroom. Using video systems, students can access a lecture which was missed or can see a lecture again for emphasis or clarification. Teaching assistants of the Mathematics Department are also available in the center for tutoring services. The computer lab contains Sun Sparc Workstations and IBM Risc 6000 workstation which students use with MAPLE, a computer algebra system. The IBM Computer Classroom contains twenty IBM computers networked on Token Ring.

At this time, the center has video tapes of most of our basic courses, including MA 103, MA 105, MA 111, MA 114, MA 121, MA 131, MA 141, MA 231, MA 241, MA 242 and MA 301.

The Director of the center is Dr. Joe Marlin. The center supervisor is Denise Seabrooks. The center is open seventy-one hours per week and is located in Harrelson Hall.

HONORS AND AWARDS

The department recognizes its superior students with the following annual awards:
Hubert V. and Mary Alice Park Scholarship—An award made to an outstanding rising junior or senior in mathematics.

John W. Cell Scholarships—An award for an outstanding rising junior or senior in mathematics.

Carey Mumford Scholarship—An award to an outstanding sophomore, junior or senior in mathematics.

Levin-Anderson Award An award for that student who has the best performance in the William Lowell Putnam Examination. (This award is not restricted to mathematics majors).

Charles N. Anderson Scholarship An award for an outstanding sophomore in mathematics.

Charles F. Lewis Scholarship An award for an outstanding senior who is a double major in mathematics mathematics education.

Mrs. Roberts C. Bullock Scholarship—An award for an outstanding mathematics major who has also demonstrated an interest in the English language.

Howard A. Petrea Scholarship An award for an outstanding junior or senior in mathematics.

The department also has a chapter of the National Mathematical Honorary Fraternity Pi Mu Epsilon. Membership is open to those students with superior performance in mathematics courses. Professor Robert Silber is currently the faculty advisor.

MATHEMATICS CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101, CH 121 General Chemistry I	4	CSC 110 Intro. to Programming	3
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 141 Analytic Geometry & Calc. I	4	MA 241 Analytic Geometry & Calc. II	4
PE 100 Health & Physical Fitness	1	Advised Elective	3
History Elective	3	Intermediate Foreign Language Elective	3
	15	Physical Education Elective	1
			1* 18

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 225 Struct. Real Num System	3	MA 341 Applied Differential Equations I	3
MA 242 Analytic Geometry & Calc. III	4	MA 407 Intro. to Modern Algebra	3
PY 205 General Physics I	4	PY 208 General Physics II	4
Advised Elective	3	Social Science Elective ¹	3
Literature Elective	3	Free Elective	3
Physical Education Elective	1	Physical Education Elective	1
	18		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 405 Intro. Linear Alg. & Matrices	3	MA 421 Intro. to Probability ²	3
MA 425 Mathematical Analysis I	3	MA 426 Mathematical Analysis II	3
Advised Elective	3	Advised Elective	3
Social Science Elective ¹	3	Humanities Social Science Elective ¹	3
Free Elective	3	Free Elective	3
	15		15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Humanities Social Science Electives	6	Humanities Social Science Elective ¹	3
Mathematics Electives	6	Mathematics Electives	6
Free Elective	3	Free Electives	6
	15		15

Minimum Hours Required for Graduation 126*

¹Of the 18 hours required as social science electives or humanities/social science electives, 6 must be at the 300 level or above.

²If ST 371 & 372 are taken in place of MA 421, the number of hours taken as advised electives is reduced by 3.

³Grades of D are not accepted in any required mathematics course numbered below 400 and only one D grade is permitted in mathematics courses numbered 400 or above in the mathematics electives category. D grades are not acceptable in ENG 111 and ENG 112. At most, one D grade is acceptable among the following: CH 101, CSC 101, PY 205, PY 208, MA 421 (ST 371, ST 372).

MATHEMATICS CURRICULUM, APPLIED MATHEMATICS OPTION

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101, CH 121 General Chemistry I	4	CSC 110 Intro. to Programming	3
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
MA 141 Analytic Geometry & Calc. I	4	MA 241 Analytic Geometry & Calc. II	4
PE 100 Health & Physical Fitness	1	Intermediate Foreign Language Elective	3
History Elective	3	Social Science Elective ³	3
	15	Physical Education Elective	1
			17

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 225 Struct. Real Num. Syst.	3	MA 341 Applied Diff. Equations I	3
MA 242 Analytic Geometry & Calc. III	4	MA 407 Intro. to Modern Algebra	3
PY 205 General Physics I	4	PY 208 General Physics II	4
ST 371 Intro. to Probability/Stat. ²	3	ST 372 Intro. Stat. Infer. & Regres. ²	3
Literature Elective	3	Social Science Elective ³	3
Physical Education Elective	1	Physical Education Elective	1
	18		17

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 405 Intro. Linear Alg. & Matrices	3	MA 426 Mathematical Analysis II	3
MA 425 Mathematical Analysis I	3	MA 432 Mathematical Models	3
Approved Elective	3	Approved Elective	3
Social Science Elective ³	3	Humanities/Social Science Elective ³	3
Free Elective	3	Free Elective	3
	15		15

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Approved Elective	3	Approved Elective	3
Humanities/Social Science Elective ¹	3	Humanities/Social Science Elective ¹	3
Mathematics Elective	3	Mathematics Elective	3
Free Electives	5	Free Electives	5
	15		14

Minimum Hours Required for Graduation:126⁴

⁴Of the 18 hours required as social science electives or humanities/social science electives, 6 must be at the 300 level or above.

⁵ST 371 & 372 may be replaced by MA 421, which would be more successfully handled in the junior year; in that case, an additional approved elective is required and two electives should be taken during the sophomore year.

⁶Grades of D are not accepted in any required mathematics course numbered below 400 and only one D grade is permitted in mathematics courses numbered 400 or above in the mathematics electives category. D grades are not acceptable in ENG 111 and ENG 112. At most, one D grade is acceptable among the following: CH 101, CSC 101, PY 205, PY 208, MA 421 (ST 371, ST 372).

MINOR IN MATHEMATICS

The Department of Mathematics offers a minor in mathematics to majors in any field except mathematics. The minor program consists of successful completion with a grade of C or better of any five three-semester-hour courses selected from among MA 225, or MA 222, but not both, and any mathematics courses numbered 300 or above.

PHYSICS

Cox Hall (Room 105)

Professor R. R. Patty, Head of Department

Professor G. E. Mitchell, Associate Department Head

Professor D. R. Tilley, Coordinator of Advising

University Professor: G. Lucovsky

Alumni Distinguished Undergraduate Professors: C. R. Gould, D. G. Haase

Professors: D. E. Aspnex, J. Bernhole, K. T. Chung, S. R. Cotanch, W. R. Davis, W. O. Doggett, R. E. Fornes, C. R. Gould, D. G. Haase, C. E. Johnson, K. L. Johnston, G. H. Katzin, F. Lado Jr., G. Lucovsky, J. D. Memory, G. E. Mitchell, J. R. Mowat, R. J. Nemanich, M. A. Paesler, J. Y. Park, R. R. Patty, J. S. Risley, D. E. Sayers, J. F. Schetzina, D. R. Tilley; Adjunct Professors: S. Datz, G. J. Iafrate, J. Narayan, M. A. Strocio, J. M. Zavada; Professors Emeriti: G. L. Hall, A. W. Jenkins, J. T. Lynn, A. C. Menius, Jr., E. R. Manning, L. W. Seagondollar; Associate Professors: G. C. Cobb, J. W. Cook, C. R. Ji, M. A. Klenin, G. W. Parker, S. P. Reynolds; Adjunct Associate Professors: E. O. Edney, D. C. Koningsberger, R. M. Panoff, J. F. Shriner Jr., A. S. Schlachter, W. Westerveld; Associate Professor Emeritus: D. H. Martin; Assistant Professor: H. Ade, R. J. Beshner, J. M. Blondin, D. C. Ellison, E. F. Moore, C. M. Roland; Assistant Professor Emeritus: H. L. Owen; Adjunct Assistant Professor: J. W. Spence; Associate Members of the Department: J. M. A. Danby (Mathematics), R. M. Kolbas (ECE), L. K. Norris (Mathematics), D. L. Ridgeway (Statistics), E. C. Theil (Biochemistry).

Physics is the fundamental science of observation, measurement and mathematical description of nature. In addition to establishing basic knowledge of physical phenomena, physics provides the foundation for modern technology. Contributions by physicists are wide ranging: discovery of elementary particles, invention and use of instruments to investigate interplanetary space, study of processes fundamental to the release of thermo nuclear energy, development of lasers and solid state devices, research on the structure and interaction of nucleons, nuclei, atoms, molecules, and ions.

PROGRAMS

The Physics Department offers a program of study at the undergraduate level which provides the student with a strong fundamental background and with course options allowing deeper study of selected areas of individual interest. At the graduate level, a comprehensive fundamental preparation is followed by specialization and research in one of the following areas: atmospheric, astrophysics, atomic, nuclear magnetic resonance, relativity and solid state physics. (See listing of graduate degrees and consult the *Graduate Catalog*.)

PHYSICS CURRICULUM

The undergraduate curriculum in physics provides the basic training for a career in physics or for graduate study. The curriculum leads to a Bachelor of Science in Physics.

FRESHMAN YEAR			
Fall Semester	Credits	Spring Semester	Credits
CH 101 General Chemistry I	4	CH 107 Principles of Chemistry	4
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
MA 141 Analytic Geometry & Calc. I	4	MA 241 Analytic Geometry & Calc. II	4
PE 100 Health & Physical Fitness	1	PY 201 General Physics	4
PY 101 Perspectives on Physics	1	Physical Education Elective	1
Humanities Social Science Elective	3		

16

16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 242 Analytic Geometry & Calc. III	4	MA 341 Applied Differential Equations I	3
PY 202 General Physics	4	MA 405 Linear Algebra Matrices	3
Humanities/Social Science Elective	3	PY 203 General Physics	4
Free Elective	3	Humanities/Social Science Elective	3
Physical Education Elective	1	Free Elective	3
	16	Physical Education Elective	1
			17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 401 Applied Differential Equations II	3	ENG 333 Comm. for Science & Research	3
PY 411 Mechanics I	3	PY 412 Mechanics II	3
PY 414 Electricity & Magnetism I	3	PY 413 Thermal Physics	3
Humanities/Social Science Elective	3	PY 415 Electricity & Magnetism II	3
Free Elective	3	Free Elective	3
	15		15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PY 401 Modern & Quantum Physics I	3	PY 402 Modern & Quantum Physics II	3
PY 452 Advanced Physics Lab	1	PY 452 Advanced Physics Lab	1
Humanities/Social Science Elective	3	Humanities/Social Science Elective	3
Technical Electives	6	Technical Electives	6
PY Elective	3	Free Elective	3
	16		16

Minimum Hours Required for Graduation 126

MINOR IN PHYSICS

The Physics Department offers a minor in physics to majors in any field except physics. To complete the minor 17 hours of specified physics courses are required, consisting of PY 205, 208, 407 (or 201, 202, 203) and two of PY 228, 411, 412, 413, 414, 415, 441.

STATISTICS

Cox Hall (Room 110)

Professor D. L. Solomon, Head of the Department

Assistant Professor B. J. Stines, Undergraduate Administrator

William Neal Reynolds Professor: B. S. Weir

Alumni Distinguished Graduate Professor: B. B. Bhattacharyya

Professors: R. L. Berger, B. B. Bhattacharyya, P. Bloomfield, D. D. Boos, C. Brownie, D. A. Dickey, A. R. Gallant, T. M. Gerig, F. Giesbrecht, H. J. Gold, T. Johnson, J. F. Monahan, K. H. Pollock, C. H. Proctor, C. P. Quisenberry, J. O. Rawlings, D. L. Ridgeway, D. L. Solomon, W. H. Swallow, J. L. Wasik, B. S. Weir; Adjunct Professors: H. T. Bhattacharyya, J. R. Chromy, A. L. Finkner, J. H. Goodnight, N. Kaplan; Professors Emeriti: C. C. Cockerham, A. H. E. Grandage, R. J. Hader, D. W. Hayne, D. D. Mason, R. J. Monroe, L. A. Nelson, J. A. Rigney, R. G. D. Steel, H. R. van der Vaart, O. Wesler; Associate Professors: E. J. Dietz, S. P. Ellner, A. C. Linnerud, D. W. Nychka, S. G. Pantula, T. W. Reiland, C. E. Smith, L. A. Stefanski; Adjunct Associate Professor: W. W. Piegorsch; Assistant Professors: M. Davidian, M. L. Gumpertz, J. Hughes-Oliver, T. B. Kepler, J. C. Lu, B. J. Stines, S. B. Zeng; Adjunct Assistant Professors: M. M. Lutz, M. V. Smith; Senior Statisticians: S. B. Donaghy, D. W. Turner; Assistant Statisticians: P. L. Marsh, S. L. Peck; Teaching Laboratory Supervisor: J. T. Arnold; Associate Members of the Statistics Faculty: W. R. Atchley (Genetics), T. H. Emigh (Genetics), M. M. Goodman (Crop Science), A. R. Hall (Economics), V. K. Smith (Economics), M. W. Suh (Textiles); Associate Members of the Biomathematics Faculty: J. W. Bishir (Mathematics), L. B. Crowder (Zoology), J. F. Gilliam (Zoology), T. Johnson (Economics), G. Namkoong (Genetics), H. E. Schaffer (Genetics), S. M. Schneider (Plant Pathology), J. F. Selgrade (Mathematics), R. E. Stinner (Entomology), G. G. Wilkerson (Crop Science); Adjunct Professors of Biomathematics: M. W. Anderson, P. L. Morgan; Adjunct Assistant Professor of Biomathematics: P. Dixon.

Statistics is the body of scientific methodology which deals with the logic of experiment and survey design, the efficient collection and presentation of quantitative information, and

the formulation of valid and reliable inferences from sample data. The computer is used as a research tool by the statistician to perform the tasks of management and analysis of data collected from experiments and surveys.

The Department of Statistics is part of the Institute of Statistics, which includes Departments of Biostatistics and Statistics at Chapel Hill. The Department of Statistics provides instruction, consultation and computational services on research projects for other departments of all colleges at North Carolina State University including the Agricultural Research Service. Department staff are engaged in research in statistical theory and methodology. This range of activities furnishes a professional environment for training students in the use of statistical procedures in the physical, biological and social sciences, and in industrial research and development.

OPPORTUNITIES

The importance of sound statistical thinking in the design and analysis of quantitative studies is generally recognized and is reflected in the abundance of job opportunities for statisticians. Industry relies on statistical methods to control the quality of goods in the process of manufacture and to determine the acceptability of goods produced. Statistical procedures based on scientific sampling have become basic tools in such diverse fields as weather forecasting, opinion polling, crop and livestock estimation, and business trend prediction. Because one can improve the efficiency of use of increasingly complex and expensive experiment and survey data, the statistician is in demand wherever quantitative studies are conducted.

SCHOLARSHIPS AND AWARDS

The Department of Statistics recognizes the importance of superior academic performance through the awarding of scholarships and certificates of merit. Two scholarships are available for the freshman year for the purpose of attracting academically superior students. The North Carolina State University Chapter of Mu Sigma Rho, the national statistics honorary fraternity, accepts as members students who have had superior performance in statistics courses. Also, the outstanding senior statistics student is recognized through the awarding of an engraved plaque.

STATISTICS CURRICULUM

The undergraduate curriculum provides basic training for a career in statistics or for graduate study and leads to the Bachelor of Science in Statistics. In addition to statistics, the curriculum includes study in mathematics, computer science, and the biological/physical sciences. While fulfilling their major elective requirements, students can either elect a minor or distribute their study across fields exploring the application of statistics in other fields, such as agriculture and life sciences, computer science, economics and business, industrial engineering, and the social sciences. A cooperative work study option is also available.

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Cred. Is.</i>
E 115 Intro. to Comp. Environ.	1	CSC 110 Intro to Programming PASCAL or	
ENG 111 Composition & Rhetoric	3	CSC 112 Intro to Programming FORTRAN .	3
MA 141 Analytic Geometry & Calculus I	4	ENG 112 Composition & Reading	3
PMS 100 Orientation to PAMS	1	MA 241 Analytic Geometry & Calculus II	1
ST 101 Statistics by Example	3	Science Elective	4
PE 100 Health & Physical Fitness	1	Physical Education Elective	1
Humanities Social Science Elective	3		
	16		15

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EC 201 Intro. to Economics	3	COM 110 Public Speaking	3
MA 242 Analytic. Geometry & Calculus III	4	MA 305 Elementary Linear Algebra	3
ST 301 Statistical Methods I	3	SOC 202 Principles of Sociology or	
Science Elective ¹	4	PSY 200 Intro. to Psychology	3
Physical Education Elective	1	ST 302 Statistical Methods II	3
	15	Science Elective ¹	4
		Physical Education Elective	1
			17

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 331 Com. for Engineering & Tech.	3	ST 422 Intro. to Mathematical Statistics II	3
ST 421 Intro. to Mathematical Statistics I	3	ST 431 Intro. to Experimental Design	3
ST 430 Intro. to Regression Analysis	3	ST 432 Intro. to Survey Sampling	3
Major Elective ²	3	Humanities/Social Science Elective	3
Science Elective	3-4	Major Elective ²	3
	15 16	Mathematics Elective ³	3
			18

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ST 435 Stat. Meth. for Qual. & Prod. Improv.	3	ST 445 Intro. to Stat. Comp. & Data Mgmt. ⁴	3
Humanities/Social Science Elective	3	Humanities/Social Science Elective	3
Major Elective ²	3	Major Elective ²	3
Major Elective ²	3	Statistics Elective ⁵	3
Free Elective	3	Free Elective	3
	15	Free Elective	3
			18

Minimum Hours Required for Graduation 129⁶

¹Two sequences selected from CH 101-107; PY 205-208; BS 100 and BO 200 or ZO 201; MEA 101 with 110 and MEA 102 or 130 or 200. At least one year of CH or PY.

²The major elective courses, selected from a list of approved major electives, require the approval of student's advisor.

³Mathematics elective to be one course selected from MA 225, 341, 425, 427, 428, or 511.

⁴A major written report required.

⁵Statistics elective to be taken from a list of Statistics major elective courses.

⁶Not more than one D grade will be accepted in the required ST, CSC and MA courses, and the major electives (with a grade of C or better required in ST 421).

MINOR IN STATISTICS

The Department of Statistics offers a minor in statistics to majors in any field except statistics. The minor program consists of the successful completion of ST 301-302, ST 371-372 or ST 421-422, and one other approved Department of Statistics course with a grade of C or better in each course.

COLLEGE OF TEXTILES

College of Textiles, (Room 3-421) Centennial Campus

R. A. Barnhardt, *Dean*

D. R. Buchanan, *Associate Dean, Extension and Applied Research*

P. L. Grady, *Associate Dean*

G. N. Mock, *Associate Dean, Academic Affairs*

C. L. Barton, *Assistant to the Dean, Student Services and Placement*

P. L. Garwig, *Librarian, Burlington Textiles Library*

The field of textiles is broad. It covers almost every aspect of our daily lives with applications in medicine, space, recreation and sports, personal safety, environmental improvement and control, transportation, household and apparel uses. These versatile materials, textiles, are made to design specifications by a variety of modern high speed processes, utilizing tools such as lasers, electronics and computers. Textiles begins with the synthesis of fibers by man or by nature; textiles are carried through many processes for fabric formation, including the steps necessary to make fabrics useful, such as the manufacture of dyestuffs and colorants, chemical auxiliaries and finishes, and cutting and fashioning into end use products.

The approximately 5,000 graduates of the College of Textiles hold diverse positions, many in North Carolina. In the textile and related industries, occupations range from manufacturing management, sales, and corporate management to designing and styling, research and development, technical service, quality control and personnel management. These textile graduates are in the creative and management decision-making aspects of the industry. They plan the flow of materials, processes and information. They create new products and processes. They solve product and process problems. They create styles, designs, patterns, colors, textures, and structures for apparel, home and industrial uses. They engineer systems and products required of industrial, space, medical, apparel and other uses of textile products. They deal with computers, automation, product quality, plant performance and environmental problems. They manage large and small companies, personnel, and systems.

The College of Textiles prepares its graduates for careers in these occupations. A broad background is stressed; two-thirds of the course work normally comes from other departments of the University. Opportunities remain excellent, with the college maintaining one of the University's best placement records. Demand for textile graduates from North Carolina State University is particularly strong, due mainly to the strength of the academic programs. These programs are offered by two degree granting departments: Textile and Apparel Management, and Textile Engineering, Chemistry, and Science.

CURRICULA

The College of Textiles offers a broad choice of curricula from which to choose. Bachelor of Science programs in Textiles, Textile and Apparel Management, Textile Materials Science and Textile Chemistry are available. These programs allow students to choose from a wide range of courses in addition to required core courses. A Bachelor of Science in Textile Engineering, offered jointly by the College of Textiles and the College of Engineering, is also available. The textile student's curriculum includes humanities, social sciences and basic sciences and may include concentrations in business, economics, industrial engineering, mathematics, physics, chemistry, computer science or statistics. A variety of dual degree possibilities are open to textile students, usually requiring at least 12 semesters additional study.

Inasmuch as professional textiles study is concentrated in the last two years of the student's program, it is possible for students from junior or community colleges, or other institutions of higher learning, to transfer to the College of Textiles with a minimum loss of time.

FIELD TRIPS

For certain textile courses, it is desirable for the student to see the manufacturing process under actual operating conditions. When possible, student groups visit outstanding manufacturing plants. Trip participation is required; transportation costs and other travel expenses, while held to a minimum, are paid by the student.

SUMMER EMPLOYMENT

Job opportunities for summer employment are available for textile students. Placement assistance is available through the college placement office and frequently can be arranged in the student's home community. Qualified students may arrange to receive academic credit through the Summer Intern program.

DEGREES

Upon completion of programs in either textiles, textile and apparel management, textile materials science, textile chemistry or textile engineering, the degree of Bachelor of Science is conferred.

The College of Textiles offers the following graduate degrees: Master of Textiles; Master of Science in Textiles, Master of Science in Textile Chemistry, Doctor of Philosophy in Fiber and Polymer Science, and Doctor of Textile Technology and Management. For general requirements consult the *Graduate Catalog*.

By faculty agreement candidates for the Doctor of Philosophy degree in other schools of this University may specialize in textile-related subjects. In such cases, research is usually done in textiles.

ELI WHITNEY DOUBLE DEGREE PROGRAM IN TEXTILE AND APPAREL MANAGEMENT AND INTERNATIONAL STUDIES

The joint program between the College of Textiles and the College of Humanities and Social Sciences allows a student to earn a B.S. degree in Textile and Apparel Management and a B.A. degree in Multidisciplinary Studies with a concentration in International Studies. This dual degree is designed to prepare students for work in the increasingly international textile industry. The program includes all the technical course requirements associated with the Textile and Apparel Management degree. For the B.A. in Multidisciplinary Studies, students choose from among three areas of concentration: the Pacific Rim (language study in Japanese or Chinese), Latin America (language study in Spanish), or Europe (language study in German or Italian). The program, which takes four to five years to complete, also includes possible overseas internships.

Merit scholarship awards are available for high-achieving students who participate in the double degree program. For more information, contact the Department of Textile and Apparel Management, Centennial Campus, Rm 3245 Textile Complex or the Assistant Dean of Undergraduate Studies, College of Humanities and Social Sciences, 106 Caldwell Hall.

FOUR-ONE PROGRAM

The College of Textiles has a program which permits a student with a baccalaureate degree from an accredited college or university to complete the requirements for a Bachelor of Science degree in textiles, textile and apparel management, textile materials science or textile chemistry after the satisfactory completion of a minimum of one year of study.

Applicants should have completed basic economics, mathematics and chemistry requirements comparable with those required for the textile degree sought. Under these condi-

tions, the student generally may complete the degree requirements in two summer sessions and two regular semesters. Students not meeting specific requirements in business, economics, sciences, or mathematics should remove deficiencies prior to entering a specific degree program, otherwise the program of study may require three or more semesters.

Each applicant's undergraduate program is considered individually and, in general, a complete transfer of credits is possible.

HONORS PROGRAM

This program offers the exceptional student an opportunity to explore an area of special interest with exposure to various forms of research or independent study. Academically-promising entrants to the college, and students who show academic excellence during the freshman year, are assigned to honors advisers and are regarded as honors candidates. Special lectures, discussion groups and seminars in the freshman and sophomore years introduce the possibilities for future development in the honors program. Towards the end of the freshman year, selected honors candidates are invited to become full members of the honors program. In the sophomore year, with an honors adviser's consent, honors students may begin to develop programs of strength in a special interest area. This may necessitate the substitution of preferred courses for those normally required, with the exception of certain basic textile courses. In the junior and senior year the student develops special interests, culminating in an honors thesis. The honors thesis ranges from a scholarly review of a special topic to a discussion of an experimental research problem.

HONOR SOCIETY

Sigma Tau Sigma is the scholastic textile fraternity which was founded in the College of Textiles in 1929 to honor students who have a grade point average of 3.25 or higher. The main goal of this fraternity is to create a high standard of scholarship among textile students. Twice every year the local chapter selects as its prospective members junior textile students who meet the above criterion. Sigma Tau Sigma also promotes excellence by awarding a trophy to the graduating senior with the highest overall grade point average in the college.

TEXTILE SCHOLARS-IN-RESIDENCE PROGRAM

This program is sponsored by the College of Textiles and the Division of Student Affairs. It is a four year program with emphasis on a textile seminar series and educational and cultural enrichment activities. These co-curricular activities include seminars on special topics related to the textile curriculum and profession, tutorial sessions, field trips and musical and drama performances. Students are invited to join this program after their acceptance at NCSU based on their predicted performance and must maintain a GPA of 3.0 to continue. All students are housed together with upperclassmen living with freshmen whenever possible.

ASSOCIATE OF THE TEXTILE INSTITUTE (ATI) DIPLOMA

The Textile Institute with headquarters in Manchester, England is a prestigious international professional textile organization. This organization recognizes graduates from most of the College of Textiles programs who have achieved a GPA of 2.8 or higher. These graduates will be granted full exemption from the ATI examination.

Selected students enrolled in the textile design concentration with junior standing are given the opportunity to spend the spring semester of the junior year at the Scottish College of Textiles while registered for textile design courses at NCSU. Tuition and fees are paid at the regular rate to NCSU. Travel costs for the selected students will be funded through the Louis Cramer Award in textile design which is administered by the College of Textiles. Each student will be responsible for costs of accommodations, meals and other personal needs.

Similar arrangements are available for students of the Scottish College of Textiles. The total exchange program is limited to 12 credit hours.

ECOLE SUPERIEURE DES TECHNIQUES INDUSTRIELLES ET DES TEXTILES (ESTIT), LILLE, FRANCE, EXCHANGE PROGRAM

Selected students enrolled in the textile engineering and textile chemistry degree programs are given the opportunity to spend a semester or a year at ESTIT while registered at NCSU. Tuition and fees are paid at the regular rate to NCSU. Each student is responsible for cost of accommodations, meals and other personal needs.

Similar arrangements are available for students of ESTIT.

SILVER DESIGN MEDAL OF THE ROYAL SOCIETY OF ARTS, LONDON

The Royal Society of Arts, London has selected North Carolina State University as one of the universities eligible to award its silver medal to one graduate each year. This award is given to a student who demonstrates excellence in the field of textile styling design and is presented at the May commencement ceremonies.

SCHOLARSHIPS

The Directors of the North Carolina Textile Foundation and Friends of the College of Textiles have established an outstanding freshman scholarship program for textile majors:

Textile Foundation Merit Awards These scholarships are renewable for up to four years of study at \$3,500 per year, constituting an overall award of \$14,000. A tuition differential may be added to the award for an out-of-state student. Four recipients are chosen every year.

Charlus and Abraham Erlanger Merit Award One renewable scholarship for \$3,500 per year, for a total award value of \$14,000.

Charlus A. Hayes Merit Award One renewable scholarship for \$3,500 per year, for a total award value of \$14,000.

Linberger Merit Award One renewable scholarship of \$3,500 per year, for a total award value of \$14,000.

Textile Freshman Prestige Scholarships Up to twenty of these scholarships will be awarded to members of each class. Ranging from \$1,000 to \$2,000 per year, these scholarships are renewable for up to four years.

COOPERATIVE EDUCATION PROGRAM

This is a voluntary program which combines academic study with job experience. To be eligible for the program, a student must have completed two semesters at NCSU (one semester for transfer students) and have a minimum GPA of 2.25. The program provides for alternating semesters of full time study and full time work. A minimum of three work periods is required to complete the program.

FACILITIES

The new College of Textiles became a reality in the spring of 1991. The Centennial Campus, which contains the new facility as well as other research and educational facilities, has now grown to approximately 1,000 acres.

The North Carolina General Assembly allocated \$27 million to build the College of Textiles facility and an additional \$6 million for equipment modernization. The 298,000 square foot facility has been planned by the faculty and staff at the college, in conjunction with a review process for recommendation and improvements from key industry representatives. Space allocation for undergraduate programs is 34%, and for graduate and research program, 31%.

The college has developed a Model Manufacturing Facility within the new building that is capable of extruding fiber; spinning, weaving/knitting and finishing fabric; producing nonwovens; and constructing garments. This facility is the only one of its kind in the world dedicated to textile industry academic sponsorship. One of the first projects to be developed is a total and complete CIM environment within its laboratories.

The College of Textiles on the Centennial Campus is the center for textile education and research in the U.S. Within its walls are a critical mass of students, faculty, facilities, and programs that will "make a difference" for the U.S. fiber, textile, and apparel industries.

SPECIAL SERVICES

The College of Textiles offers several services and programs which enrich its academic programs.

Textile and Apparel Research is conducted on a wide variety of problems relating to the fiber, textile and apparel industries. Frequently, the problems are interdisciplinary and involve team effort. Students have an opportunity to participate in the solution to current problems.

Textiles Extension and Continuing Education is vigorously participated in by all faculty. It serves the needs of the textile industry to disseminating research findings and offering short courses for executive, scientific and supervisory personnel. The two way exchange in these activities keeps students and faculty informed on all of the latest developments.

The Office of Student Services is responsible for the placement and financial aid programs of the College of Textiles. The placement office brings together industry recruiters and students for interview sessions for permanent and summer employment. Alumni may also take advantage of the placement office.

The financial aid function is operated by a committee. It is possible for any North Carolina student to pursue an education in textiles through scholarships, loans or grants, as long as he or she maintains the University's academic standards.

TEXTILE OFF-CAMPUS TELEVISED EDUCATION (TOTE)

TOTE is a special videocassette based project designed to give any qualified person, anywhere in the world, an opportunity to participate in College of Textiles courses previously only available to those willing and able to travel to Raleigh, NC. Knowledge can be gained and college credit can be earned. Color television is the medium TOTE uses to deliver courses. Recordings are made in a specially designed studio classroom at the College of Textiles on Centennial Campus at NCSU. Regularly scheduled classes meet in the studio classroom and are recorded in such a manner as to retain the normal classroom atmosphere. Lectures are presented in total, candidly and informally. This also allows students physically in the class at NCSU, the option of viewing the tape in the library on Centennial Campus if they miss a class.

TOTE students off-campus are on a schedule approximately one week behind the University semester calendar.

TEXTILE AND APPAREL MANAGEMENT

College of Textiles, (Room 3 245) Centennial Campus

Professor T. J. Little, Head of the Department

Associate Professor: P. Banks-Lee, Associate Head and Graduate Administrator

Klopman Distinguished Professor: S. C. Winchester

Alumni Distinguished Undergraduate Professors: P. Banks-Lee; M. L. Robinson

Professors: R. A. Barnhardt, S. K. Batra, G. A. Berkstresser, R. A. Donaldson, A. H. M. El-Shiekh, S. M. Winchester; Visiting Professor: E. M. McPherson; Visiting Research Professors: H. Davis, T. Sann; Adjunct Professors: W. A. Klopman, R. W. Dent; Professors Emeriti: E. B. Grover, A. B. Moss, J. A. Porter, W. E. Shinn, W. C. Stuckey; Associate Professors: T. F. Gilmore, P. B. Hudson, L. T. Lassiter, M. L. Robinson, G. W. Smith, M. W. Suh; Adjunct Associate Professors: D. M. Powell, C. Priestland, D. L. Spanton, S. M. Zartarian, P. E. Sasser; Visiting Associate Professor: B. R. French, N. A. Hunter, W. Oxenham; Associate Professors Emeriti: E. H. Bradford, E. E. Hutchinson, J. W. Klibbe, W. E. Moser, J. W. Pardue; Assistant Professors: T. K. Ghosh, H. Hergeth, G. L. Hojce, A. M. Seyam, Adjunct Assistant Professor: R. E. Jenkins; Assistant Professors Emeriti: F. W. Massey, H. M. Middleton; Extension Specialists: J. W. Carter, L. S. Moser, C. L. Seatrunk; Instructor: E. C. Carrere; Research Assistant: W. C. Hewitt.

The Department of Textile and Apparel Management offers bachelor of science degrees in Textile and Apparel Management and in Textiles. Each degree permits the student to specialize in concentrations and the curricula combine a foundation both in textile management and textile technology principles and applications. The B.S. Textile and Apparel Management degree has a Management concentration and an Apparel concentration, while the B.S. Textiles degree has a Technology concentration and a Design concentration.

The B.S. in Textile and Apparel Management, together with its concentrations, provides opportunities for the student to get additional background in apparel manufacturing, production factors, law and labor relations, management science, finance and accounting.

The B.S. in Textiles, Technology concentration, offers the student a background in the technology of fibers, yarns and fabrics and the manufacturing processes involved. The Design concentration gives a broad foundation in textiles and specializes in the application of design principles to the wide range of textile materials.

Opportunities for outstanding undergraduate students are allowed in graduate studies including research sponsored by University funds and industrial and government sponsors.

The Textile and Apparel Management department also administers the Eli Whitney Scholarship program for students wishing to undertake a study of international business in conjunction with their studies in Textile and Apparel Management. This program permits the student to earn a B.A. degree as offered by the College of Humanities and Social Sciences and a B.S. degree in Textile and Apparel Management.

B.S. DEGREE IN TEXTILES, TEXTILE DESIGN CONCENTRATION

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CSC 200 Intro. Comput. & Use ¹	3
CH 121 General Chemistry I Lab	1	ENG 112 Comp. & Reading	3
ENG 111 Comp. & Rhetoric	3	MA 231 Anly. Geom. & Calc. B or	
MA 131 Anly. Geom. Calc. A or		MA 241 Anly. Geom. & Calc. II	3.4
MA 141 Anly. Geom. & Calc. I	4	TAM 170 Textile Design Orient.	1
PE 100 Health & Physical Fitness	1	TT 220 Yarn Prod. Systems	3
T 105 Intro. Text. Mat. Sci.	3	Humanities Soc. Sci. Elective ¹	3
	15	Physical Education Elective	1
			17 18
SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 101 Design Fund. I- or		PY 208 Physics Engr. Sci. II or	
DF 111 Two Dim. Design	6.3	PY 212 College Physics II	4
PY 205 Physics Engr. Sci. I or		ST 361T Intro. Stat. Engrs.	3
PY 211 College Physics I	4	TAM 272 Print Text. Design	3
TC 203 Intro. Polymer Chem. or		TC 203 Intro. Polymer Chem. or	
TMS 211 Intro. Fiber Sci.	3	TMS 211 Intro. Fiber Sci.	3
TT 250 Text. Fab. Form. Struc	3	TT 341 Knitting Systems	3
Humanities Soc. Sci. (EC 201)	3	Physical Education Elective	1
Physical Education Elective	1		
	17-20		17
JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TAM 330 Text. Meas. Qual. Cont.	4	ENG 331 Commun. Engr. & Tech.	3
TAM 371 Woven Text. Design	3	TAM 372 Knitted Text. Design	3
TC 301 Tech. Dyeing Fin.	4	TAM 380 Mgmt. Contr. Text. Syst.	3
TT 351 Weaving Systems	3	TT 305 Dir. Fib. Fab. Prod.	3
Humanities Soc. Sci. Elective ¹	3	TT 320 Mech. Sp. Yarn Mfg. Sys.	4
	17		16
		T 493 Industrial Internship in Textiles ¹	3

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TAM 470 Text. Design Studio	6	TS 460 Phys. Prop. Text. Fib.	3
TAM 495 Senior Seminar	1	TT 370 Tech. Fabric Design	4
TT 425 Text. Yarn Prod. Prop.	3	Humanities Soc. Sci. Elective ¹	6
Humanities/Soc. Sci. Elective ¹	3	Free Electives	6
Free Elective	3	New York Trip ⁴	3
	16		19

Minimum Hours Required for Graduation 133

Note: Credit gained for MA 111, Precalculus, will be considered as excess and not applicable toward satisfying the 133 minimum hours required for graduation.

¹Humanities Social Sciences Electives A minimum of 18 hours is required in addition to English 111 and 112. Selection will follow University guidelines and come from University-approved course lists. At least 6 hours of humanities are required. At least 6 hours of social sciences are required. EC 201 is specified as one of these courses. A two course graded sequence in the same discipline is required in either humanities or in social sciences. A graded sequence is defined as: a) a two-course sequence in which the first course is prerequisite to the second, or b) a two-course sequence in which the second course is at the 300 level or higher. The remaining hours will come from either humanities, social sciences or both.

²DF 101 Design Fundamentals I (6 credits): Open only to textile students with a 2.5 GPA plus acceptable portfolio, and who have been accepted into the course by the recommendation of the School of Design interview panel. This course is an elected alternative to DF 111 for certain students who meet the entry requirements. An excess of 3 credits will be incurred, and special curricular arrangements will have to be made in consonance with the academic coordinator of the student's department.

³Computer Science TDC students may elect to take DN 415 Microcomputer Graphics for Designers (3 credits) in lieu of CSC 200.

⁴Summer Internship - students are encouraged to apply for an industrial internship between their junior and senior years. The program number to sign up for is T 493. This is an optional course and will come from free electives.

⁵NEW YORK TRIP during spring break of the senior year, a 6 day program of professional visits is arranged in the city. This is a very important part of the program of study, and all students are strongly encouraged to plan ahead for this event.

B.S. DEGREE IN TEXTILES, TEXTILE TECHNOLOGY CONCENTRATION

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	3	CH 107 Principles of Chemistry	4
CH 121 General Chemistry I Lab	1	CH 127 General Chemistry II Lab	4
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
MA 131 Anly. Geom. & Calc. A or		MA 231 Anly. Geom. & Calc. B or	
MA 141 Anly. Geom. & Calc. I	4	MA 241 Anly. Geom. & Calc. II	3-4
PE 100 Health and Physical Fitness	1	TT 220 Yarn Prod. Systems	3
T 105 Intro. Text. Mat. Sci.	3	Humanities Soc. Sci. Elective ⁶	3
	15	Physical Education Elective	1
			17 18

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 200 Intro. to Computers & Use	3	PY 212 College Physics I or	
EC 201 Economics I ⁷	3	PY 208 Physics Engr. Sci. II	4
PY 211 College Physics I or		ST 361T Intro. Stat. for Engrs. ¹	3
PY 205 Physics Engr. Sci. I	4	TC 203 Intro. to Polymer Chem. or	
TC 203 Intro. to Polymer Chem. or		TMS 211 Intro. to Fiber Sci.	3
TMS 211 Intro. to Fiber Sci.	3	TT 320 Mech. Sp. Yn. Mfg. Syst.	4
TT 250 Text. Fab. Form Struct.	3	TT 341 Knitting Systems	3
Physical Education Elective	1	Physical Education Elective	1
	17		18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TAM 330 Text. Meas. Qual. Cont.	4	ENG 331 Commun. Engr. Tech.	3
TC 301 Tech. Dyeing & Finish.	3	TAM 380 Mgmt. & Cont. Text. Syst.	3
TT 351 Weaving Systems	3	TT 305 Dir. Fiber to Fab. Prod.	3
TT 425 Text. Yarn Prod. & Prop.	3	TT 370 Technical Fabric Design	4
Humanities Soc. Sci. Elective ⁸	3	Textile Concentration ⁹	3
	17	Free Elective	3
			19

279

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TAM 495 Senior Seminar	1	Humanities/Soc. Sci. Electives ²	6
TS 460 Phys. Prop. Text. Fib.	3	Textile Concentration ³	6
Humanities/Soc. Sci. Elective ²	3	Free Elective	3
Textile Concentration ³	6		15
Free Elective	3		
	16	Minimum Hours Required for Graduation	134

Note: Credit gained for MA 111 will be considered as excess credit and not applicable toward satisfying the 134 minimum hours required for graduation.

¹ST 361(T) Recommended for Textile students.

²Humanities/Social Science Elective—A minimum of 18 hours is required in addition to English 111 and 112. Selection will follow University guidelines and come from University-approved course lists. At least 6 hours in humanities and 6 hours in social sciences are required. EC 201 is a specified social science course. A two-course graded sequence in the same discipline is required in either humanities or social sciences. A graded sequence is defined as: a) a two-course sequence in which the first course is prerequisite to the second, or b) a two-course sequence in which the second course is at the 300 level or higher. The remaining hours will come from either humanities, social sciences or both.

³Textile Concentrations (15 credit hours)—Select 9 credit hours from one group, either group A or group B, and 6 additional hours from any of the groups. (Credit will not be allowed for both TAM (1D) 371 and TT 451.)

A	B	C
<i>Mfg. Tech.</i>	<i>Quality Control</i>	<i>Color & Design</i>
TT 405	IE 352	TAM 371
TT 420	TAM 431	TAM 372
TT 443	TAM 490	TC 305
TT 450	TAM 530	TT 350
TT 451	TES 500	
TT 490		

D	E	F
<i>Apparel Tech.</i>	<i>Fiber Science</i>	<i>Mgt. Science</i>
TAM 218	CH 220	ACC 280
TAM 315	T 402	TAM 381
TAM 316	TC 412	TAM 480
	TS 461	TAM 487

**B.S. DEGREE IN TEXTILE AND APPAREL MANAGEMENT,
APPAREL MANAGEMENT CONCENTRATION**

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry	3	EC 201 Economics I ¹	3
CH 121 General Chemistry Lab	1	ENG 112 Composition & Reading	3
ENG 111 Composition & Rhetoric	3	TAM 218 Intro. Apparel Tech. Mgmt.	3
MA 121 Elements of Calc. or	4	TC 203 Intro. Poly. Chem.	3
MA 131 Anly. Geom. Calc. A	4	TT 220 Yarn Prod. Systems	3
PE 100 Health & Physical Fitness	1	Physical Education Elective	1
T 105 Intro. Text. Mat. Sci.	3		16
	15		

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 280 Managerial Accounting	3	BUS/ST 350 Econ. & Bus. Stats. or	3
EC 301 Intro. Microeconomics ¹	3	ST 361 Intro. Stat. Engr.	3
PY 205 Physics Engr. Sci. I or	3	EC 302 Inter. Macroeconomics	3
PY 211 College Physics I	4	ENG 332 Comm. Bus. Mgmt. or	3
TT 250 Text. Fab. Form Struc.	3	ENG 331 Comm. Engr. & Tech.	3
Humanities/Soc. Sci. Elective ¹	3	TAM 315 Apparel Product. I	3
Physical Education Elective	1	TAM 380 Mgmt. Cont. Text. Syst.	1
	17	Physical Education Elective	1
			16

JUNIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
BUS 360 Marketing Methods or		BUS 320 Financial Management	3
TAM 382 Prin. Soft Goods Mkt.	3	PSY 307 Ind. Org. Psy. I	3
TAM 331 Qua. Ctr. Text. Pro. Mgmt.	3	TAM 316 Apparel Prod. II	3
TMS 211 Intro. Fiber Sci.	3	TAM 480 Text. Prod. Cost. Cont.	3
Humanities Soc. Sci. Elective ¹	3	TC 301 Tech. Dyeing & Fin.	4
Free Elective	3	Free Elective	3
	15		19

SENIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
TAM 415 Apparel Product Dev.	3	IE 352 Work Anly. & Design or	
TAM 431 Fab. Perform. Test.	3	TAM 416 Apparel Production III	3
TAM 481 Prod. Cost. Text. & App.	3	TAM 484 Mgr. Dec. Mak. Text. Fm.	3
TAM 482 Text. Mkt. Mgmt.	3	Textile Elective-	3
TAM 487 Text. App. Lab. Mgmt. ²	3	Textile Elective-	3
Humanities Soc. Sci. Elective ³	3	Free Elective	3
	18		15

Minimum Hours Required for Graduation 131

Notes: 1. Credit gained for MA 111 or lower numbered math courses will be considered a credit and not applicable toward satisfying the minimum hours required for graduation.

2. A minimum grade of C is required in EC 201, ACC 280, and TAM 380 for graduation in this concentration.

3. PSY 200 is not a prerequisite for PSY 307 for Apparel Management Concentration students.

4. MA 121 or 141 must be taken by those students planning to go to Graduate School.

¹Humanities Social Science Electives—University guidelines will be followed in that a minimum of 18 hours is required in addition to English 111 and 112. Selection will be from University approved lists with at least 6 hours from each of humanities and social sciences.

²In this curriculum EC 201, EC (ARE) 301, and P&J 307 are required. These courses satisfy University requirements of 6 hours in social sciences and the departmental requirement of a two-course graded sequence in the same discipline. At least 6 of the remaining hours must be selected from the humanities area. The final 3 hours can be selected from humanities or social science course listings.

³Textile Electives (12 credit hours required); TAM 431 and TAM 487 are required Textile electives in this concentration. Students may select two other courses from among the following: TT 305, 320, 341, 351, 370, 405, 420, 425, 443, 450, 451, TAM 383.

B.S. DEGREE IN TEXTILE AND APPAREL MANAGEMENT, TEXTILE MANAGEMENT CONCENTRATION

FRESHMAN YEAR

Fall Semester	Credits	Spring Semester	Credits
CH 101 General Chemistry I	3	EC 201 Economics I ¹	3
CH 121 General Chemistry Lab	1	ENG 112 Composition & Reading	3
ENG 111 Comp. & Rhetoric	3	TAM 218 Intro. App. Tech. Mgmt.	3
MA 121 Elements of Calc. A or		TC 203 Intro. Polymer Chemistry	3
MA 131 Anly. Geom. Calc. A or		TT 220 Yarn Prod. Systems	3
MA 141 Anly. Geom. & Calc. I	4	Physical Education Elective	1
PE 100 Health & Physical Fitness	1		
T 105 Intro. Text. Mat. Sci.	3		
	15		16

SOPHOMORE YEAR

Fall Semester	Credits	Spring Semester	Credits
ACC 280 Mgr. Account.	3	BUS ST 350 Econ. & Bus. Stat.	3
EC 301 Intermediate Microeconomics ¹	3	EC 302 Intermediate Microeconomics ¹	3
PY 211 College Physics I or		ENG 332 Commun. Bus. Mgmt. or	
PY 205 Physics Engr. Sci. I	4	ENG 331 Commun. Eng. Tech.	3
TT 250 Text. Fab. Form. Struct.	3	TAM 380 Mgt. Cont. Text. Syst.	3
Humanities/Soc. Sci. Elective ¹	3	TMS 211 Intro. Fiber Science	3
Physical Education Elective	1	Physical Education Elective	1
	17		16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TAM 331 Qua. Ctr. Text. Prd. Mgt.	3	BUS 320 Financial Manage.	3
TAM 382 Prn. Soft Goods. Mkt. or	3	PSY 307 Indust. & Org. Psy. ¹	3
BUS 360 Mkt. Method.	3	TAM 480 Text. Prod. Cost Cont.	3
TC 301 Tech. Dye. Fin.	4	TAM 481 Product Cost. Text. App.	3
Management Elective ²	3	Textile Elective ³	3
Free Elective	3	Textile Elective ³	3
	16		18

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TAM 482 Text. Mkt. Mgmt.	3	TAM 484 Mgt. Decis. Mak. Text. Firm	3
TAM 495 Sr. Sem. Text. & App. Mgmt.	1	Humanities/Soc. Sci. Elective ¹	3
Humanities Soc. Sci. Elective ¹	3	Management Elective ²	3
Management Elective ²	3	Textile Elective ³	3
Textile Elective ³	3	Free Elective	3
Free Elective	3		15
	16	Minimum Hours Required for Graduation	129

- Notes:*
1. Credit for MA 111 or lower numbered math courses will be considered excess and not applicable toward satisfying the minimum hours required for graduation.
 2. A minimum grade of C is required in EC 201, ACC 280, and TAM 380 for graduation in this concentration.
 3. PSY 200 is not a prerequisite for PSY 307 for Textile Management students.
 4. MA 131 or 141 must be taken by students in the Management Science Option or those students planning to go to Graduate School.

¹Humanities Social Science Electives—University guidelines will be followed in that a minimum of 18 hours is required in addition to English 111 and 112. Selection will be from university approved lists with at least 6 hours from each of humanities and social sciences.

In this curriculum EC 201, EC (ARE) 301, and PSY 307 are required. These courses satisfy University requirements of 6 hours in social sciences and the departmental requirement of a two-course graded sequence in the same discipline. At least 6 of the remaining hours must be selected from the humanities area. The final 3 hours can be selected from approved humanities or social science course listings.

²Textile Elective (12 Credit Hours required): Students will select four courses from the following list: TT 305, 320, 341, 351, 370, 405, 420, 425, 443, 450, 451, TAM 383, 431.

³Management Elective Options—A minimum of three courses is required from one of the following option groupings. Additionally, minors are available in Accounting, Business Management, and Industrial Engineering, and a double degree program in International Studies (the Eli Whitney Scholars Program) is also available. The minors and double degree programs generally require courses over and above the 129-hour minimum, so each student must prepare his/her own program with care.

⁴Production Factors Option—(Possible IE Minor) IE 307, 311, 420, 355, PSY 340, T 401, ST 361.

⁵Labor and Law Relations Option—TAM 381, 487, BUS 320, BUS 332, EC 431, BUS 307, BUS 308, IE 355, PSY 340, T 401, 422, BUS 455, BUS 465.

⁶Finance and Accounting Option—(Possible Accounting Minor) ACC 210 (to be taken instead of 280), ACC 220, 320, 310, 311, 330, 420, BUS (ST) 350, BUS (EC) 404, BUS 422, EC 448, EC 451.

TEXTILE ENGINEERING, CHEMISTRY, AND SCIENCE

College of Textiles, (Room 3-250) Centennial Campus

Professor C. D. Livengood, Head of the Department

Professor B. S. Gupta, Assistant Head Undergraduate Programs

Professor K. R. Beck, Assistant Head Graduate Programs

Alumni Distinguished Undergraduate Professor: C. D. Livengood

Burlington Professor: M. H. Mohamed

Charles A. Cannon Professor: S. P. Hersh

Celanese Corporation Professor: J. A. Cuculo

Ciba-Geigy Professor: H. S. Freeman

Cone Mills Professor: R. McGregor

Professors: R. L. Barker, K. R. Beck, D. R. Buchanan, J. A. Cuculo, H. S. Freeman, P. L. Grady, B. S. Gupta, S. P. Hersh, C. D. Livengood, R. McGregor, G. N. Mock, M. H. Mohamed, C. B. Smith, M. H. Theil, C. Tomasino, P. A. Tucker, Adjunct Professors: R. Goldman, T. Iijima, R. K. Koger, J. B. Levy, J. Preston, L. G. Roldan, T. Tam; Professors Emeriti: J. F. Bogdan, K. S. Campbell, D. M. Cates, P. D. Emerson, R. D. Gilbert, D. S. Hamby, P. R. Lord, H. A. Rutherford, W. R. Walsh, W. M. Whaley, R. W. Wark; Associate Professors: T. G. Clapp, H. Hamouda, A. E. Tonelli; Adjunct Associate Professors: W. P. Behnke, L. D. Claxton, A. C. Lohr, W. R. Martin, Jr.; Associate Professors Emeriti: T. H. Guion, A. C. Hayes, T. G. Rochow; Assistant Professors: S. M. Hudson, W. J. Jasper, C. M. Pastore, J. W. Rucker, J. P. Rust; Adjunct Assistant Professors: A. C. Bullerwell, R. N. Elliott III, J. Roper; Associate Members of the Faculty: S. K. Batra (Textile and Apparel Management), R. E. Fornes (Physics).

The Department of Textile Engineering, Chemistry, and Science offers bachelor of science degrees embracing a number of disciplines. Students receive a fundamental knowledge of the science and engineering involved in the production of polymers, fibers, yarns and fabrics, and products based on them, and the process of dyeing and finishing.

The **B.S. in Textile Chemistry** is heavily oriented to the chemistry of polymers, their formation, and the preparation of textile materials for the consumer including scouring, bleaching, printing, dyeing and finishing. The degree program offers four different concentrations: (a) dyeing and finishing management, (b) dyeing and finishing operations, (c) dyeing and finishing science, and (d) polymer chemistry. The first two concentrations are primarily for students who want a bachelor of science degree, whereas the other concentrations are oriented toward students wanting advanced studies. However, the student taking dyeing and finishing operations or dyeing and finishing management can use elective courses to achieve a background suitable for graduate studies.

The **B.S. in Textile Engineering** provides a broad base of fundamental engineering courses as a foundation for studies in textile engineering. The textile engineering courses deal with the application of scientific and engineering principles to the design and control of all aspects of fiber, textile and apparel process, products and machinery. These include natural and man-made materials, interaction of materials with machines, safety and health, energy conservation, and waste and pollution control. The B.S. in Textile Engineering is offered jointly with the College of Engineering.

The **B.S. in Textile Materials Science** provides students with a fundamental knowledge of textiles material, including the science of modern materials and composites, as well as a technical understanding of the interactions between materials and machines in manufacturing operations. This curriculum combines elements of fiber physics, engineering, polymer science and production technology. It incorporates modern aspects of fiber materials science, including composites and advanced materials, computer applications and modern measurements into a science based program.

B.S. DEGREE IN TEXTILE CHEMISTRY, DYEING AND FINISHING MANAGEMENT CONCENTRATION

FRESHMAN YEAR

Fall Semester	Credits	Spring Semester	Credits
CH 101 General Chem. I	3	CH 107 Principles of Chem.	3
CH 121 General Chem. I Lab	1	CH 127 Principles of Chem. Lab	1
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
MA 131 Anly. Geom. Calc. A or	3	MA 231 Anly. Geom. Calc. B or	3
MA 141 Anly. Geom. Calc. I	4	MA 241 Anly. Geom. Calc. II	4
PE 100 Health and Physical Fitness	1	TC 203 Intro. to Pol. Chem.	3
TC 105 Intro. Text. & Comp.	3	Humanities/Soc. Sci. Elective ¹	3
	15		18-17

SOPHOMORE YEAR

Fall Semester	Credits	Spring Semester	Credits
CH 221 Organic Chem. I	4	CH 223 Organic Chem. II	4
EC 201 Economics I ¹	3	PY 208 Physics Engr. Sci. II or	4
PY 205 Physics Engr. Sci. I or	4	PY 212 College Physics II	4
PY 211 College Physics I	4	TC 301 Tech. Dye. Fin.	4
TMS 210 Yarn Fabric Prop.	4	TMS 211 Intro. Fiber Science	3
Physical Education Elective	1	Free Elective	3
	16		18

JUNIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
ENG 331 Comm. for Eng. & Technol.	3	PSY 307 Indust. Org. Psy. ¹	3
TC 310 Text. Prep. Fin. Chem.	3	TC 305 Intro. Color Sci. Appll.	3
TC 441 Phys. Chem. Proc. Text. I	3	TC 320 Text. Dye. Print	3
TC 461 Intro. to Fib. Form. Pol.	4	TC 412 Text. Chem. Analysis	3
Free Elective	3	TC 442 Phys. Chem. Proc. Text. II	3
Physical Education Elective	1	Physical Education Elective	1
	17		16

SENIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
ACC 280 Managerial Acct.	3	T 401 Environ. Sci. Text.	3
TAM 380 Mgmt. Contr. Text. Syst.	3	TAM 480 Text. Prod. Cost Cont.	3
Humanities ² /Soc. Sci. Elective ¹	6	TC 407 Wet Proc. Opern. & QC	3
TC Elective ²	3	Humanities/Soc. Sci. Elective ¹	3
	15	Free Elective	3
			15

Minimum Hours Required for Graduation 128

Note: Credit gained for MA 111, Algebra and Trigonometry, will be considered as excess credit and not applicable toward satisfying the 128 minimum hours required for graduation.

¹Humanities/Social Sciences Electives—University guidelines will be followed in that a minimum of 18 hours is required in addition to English 111 and 112. Six of these hours are specified: EC 201, Economics I, and PSY 307, Industrial and Organizational Psychology. Selection will be from University approved lists with at least six hours from Humanities and six hours from Social Sciences. A minimum of two electives in a graded sequence from the Social Science area and two courses in a graded sequence in the Humanities area is required. A graded sequence is defined as: a) a two-course sequence in which the first course is a prerequisite for the second; or b) a two-course sequence in which the second course is at the 300 level or higher.

²Any TC Elective Course

B.S. DEGREE IN TEXTILE CHEMISTRY DYING AND FINISHING OPERATIONS CONCENTRATION

FRESHMAN YEAR			
Fall Semester	Credits	Spring Semester	Credits
CH 101 General Chem. I	3	CH 107 Principles of Chem.	3
CH 121 General Chem. I Lab	1	CH 127 Principles of Chem. Lab	1
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
MA 131 Anly. Geom. Calc. A or		MA 231 Anly. Geom. Calc B or	
MA 141 Anly. Geom. Calc. I	4	MA 241 Anly. Geom. Calc. II	3.4
PE 100 Health and Physical Fitness	1	TC 203 Intro. to Pol. Chem.	3
TC 105 Intro. Text. & Comp.	3	Humanities Soc. Sci. Electives*	3
	15		16.17

SOPHOMORE YEAR			
Fall Semester	Credits	Spring Semester	Credits
CH 221 Organic Chem. I	4	CH 223 Organic Chem. II	4
PY 205 Physics Engr. Sci. I or		PY 208 Physics Engr. Sci. II or	
PY 211 College Physics I	4	PY 212 College Physics II	4
TMS 210 Yarn Fabric Prop.	4	TC 301 Tech. Dye Fin.	4
Humanities/Soc. Sci. Elective*	3	TMS 211 Intro. Fiber Science*	3
Free Elective	3	Physical Education Elective	1
	18		16

JUNIOR YEAR			
Fall Semester	Credits	Spring Semester	Credits
TC 310 Text. Prep. Fin. Chem.	3	ENG 331 Comm. for Eng. & Technol.	3
TC 441 Phys. Chem. Proc. Text. I	3	TC 305 Intro. Color Sci. Appli.	3
TC 461 Intro. to Fib. Form. Pol.	4	TC 320 Text. Dye. Print.	3
Humanities Soc. Sci. Elective*	3	TC 412 Text. Chem. Analysis	3
Free Elective	3	TC 442 Phys. Chem. Proc. Text. II	3
Physical Education Elective	1	Physical Education Elective	1
	17		16

SENIOR YEAR			
Fall Semester	Credits	Spring Semester	Credits
Humanities Soc. Sci. Electives*	6	T 401 Environ. Sci. Text.	3
Restricted Elective ¹	3	TC 407 Wet Proc. Opern. & QC	3
TAM, TES, TMS, or TT Elective ²	3	Humanities Soc. Sci. Elective*	3
TC Elective ¹	3	TAM, TES, TMS or TT Elective ²	3
	15	Free Elective	3
			15

Minimum Hours Required for Graduation 128

Note: Credit gained for MA 111, Algebra and Trigonometry, will be considered as excess credit and not applicable toward satisfying the 128 minimum hours required for graduation.

¹Any TC elective course.

²Any TAM, TES, TMS or TT elective course.

³Restricted elective: ST 361, ACC 280, CH elective, Math elective.

⁴Humanities and Social Sciences Electives: University guidelines will be followed in that a minimum of 18 hours is required in addition to English 111 and 112. Selection will be from University approved lists with at least six hours from Humanities and six hours from Social Sciences. A minimum of two electives in a graded sequence from the Social Science area and two courses in a graded sequence in the Humanities area is required. A graded sequence is defined as: a) a two-course sequence in which the first course is a prerequisite for the second; or b) a two-course sequence in which the second course is at the 300 level or higher.

B.S. DEGREE IN TEXTILE CHEMISTRY, DYEING AND FINISHING SCIENCE CONCENTRATION

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chem. I	3	CH 107 Principles of Chem.	3
CH 121 General Chem. I Lab	1	CH 127 Principles of Chem. Lab	1
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
MA 141 Anly. Geom. Calc. I	4	MA 241 Anly. Geom. Calc. II	4
PE 100 Health and Physical Fitness	1	TC 203 Intro. to Pol. Chem.	3
TC 105 Intro. Text. & Comp.	3	Humanities/Soc. Sci. Elective ^a	3
	15		17

SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 221 Organic Chem. I	4	CH 223 Organic Chem. II	4
MA 242 Anly. Geom. Calc. III	4	MA 341 Appl. Diff. Equat. I	3
PY 205 Physics Engr. Sci. I	4	PY 208 Physics Engr. Sci. II	4
TMS 210 Yarn Fabric Prop.	4	TC 301 Tech. Dye. Fin.	4
Physical Education Elective	1	Physical Education Elective	1
	17		16

JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TC 310 Text. Prep. Fin. Chem.	3	ENG 331 Comm. for Eng. & Technol.	3
TMS 211 Intro. to Fiber Sci.	3	TC 305 Intro. Color Sci. Appl.	3
Humanities/Soc. Sci. Elective ^a	3	TC 320 Text. Dye. Print.	3
Phys. Chem./Thermo. Elective ^b	3	TC 412 Text. Chem. Analysis	3
Free Elective	3	Phys. Chem./Thermo. Elective ^b	3
Physical Education Elective	1		15
	16		

SENIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TC 461 Intro. to Fib. Form. Pol.	4	T 401 Environ. Sci. Text.	3
Dyeing & Finishing Elective ^c	3	TC 407 Wet Proc. Opern. & QC	3
Humanities/Soc. Sci. Elective ^a	6	Humanities/Soc. Sci. Elective ^a	6
Free Elective	3	Free Elective	3
	16		15

Minimum Hours Required for Graduation 127

Note: Credit gained for MA 111, Algebra and Trigonometry, will be considered as excess credit and not applicable toward satisfying the 127 minimum hours required for graduation.

¹TC 441 442 or CH 431 - 433

²Any T, TMS, TT, TES or TC Textile Chemistry elective course

³Humanities/Social Sciences Elective—University guidelines will be followed in that a minimum of 18 hours is required in addition to English 111 and 112. Selection will be from University approved lists with at least six hours from Humanities and six hours from Social Sciences. A minimum of two electives in a graded sequence from the Social Science area and two courses in a graded sequence in the Humanities area is required. A graded sequence is defined as: a) a two-course sequence in which the first course is a prerequisite for the second; or b) a two-course sequence in which the second course is at the 300 level or higher.

B.S. DEGREE IN TEXTILE CHEMISTRY POLYMER CHEMISTRY CONCENTRATION

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chem. I	3	CH 107 Principles of Chem.	3
CH 121 General Chem. I Lab	1	CH 127 Principles of Chem. Lab	1
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
MA 141 Anly. Geom. Calc. I	4	MA 241 Anly. Geom. Calc. II	4
PE 100 Health and Physical Fitness	1	TC 203 Intro. to Pol. Chem.	3
TC 105 Intro. Text. & Comp.	3	Humanities/Soc. Sci. Elective ^a	3
	15		17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 221 Organic Chem. I	4	CH 223 Organic Chem. II	4
MA 242 Anly. Geom. Calc. III	4	MA 341 Appl. Diff. Equat. I	3
PY 205 Physics Engr. Sci. I	4	PY 208 Physics Engr. Sci. II	4
TMS 210 Yarn Fabric Prop.	4	TC 301 Tech. Dye. Fin.	4
Physical Education Elective	1	TMS 211 Intro. to Fiber Sci.	3
	17		18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 331 Comm. for Eng. & Technol.	3	TC 305 Intro. Color Sci. Appl.	3
TC 461 Intro. to Fib. Form. Pol.	4	TC 412 Text. Chem. Anly.	3
Phys. Chem./Thermo. Elective ²	3	Humanities/Soc. Sci. Electives ⁴	6
Free Elective	3	Phys. Chem./Thermo. Elective ³	3
Physical Education Elective	1	Physical Education Elective	1
	14		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Dyeing Finishing Elective ¹	3	T 401 Environ. Sci. Text.	3
Humanities/Soc. Sci. Electives ⁴	6	TC 466 Polymer Chem. Exp.	3
Polymer Chemistry Electives ²	6	Humanities/Soc. Sci. Elective ⁴	3
Free Elective	3	Polymer Chemistry Elective ²	3
	18	Free Elective	3
			15

Minimum Hours Required for Graduation 130

Note: Credit gained for MA 111, Algebra and Trigonometry, will be considered as excess credit and not applicable toward satisfying the 130 minimum hours required for graduation.

RESTRICTED ELECTIVES

¹Dyeing and finishing—3 credits from the following:

TC 310	3
TC 320	3
TC 407	3
TC 491	1
TC 505	3
TC 506	3
TC 520	3
TC 521	3
TC 530	3
TC 591	3

²Polymer Chemistry Electives 6 credits from the following:

TC 504	3
TC 561	3
TC 562	3
TC 565	3
TC 569	3
TS 460	3
T 402	3

Three additional credits from either the list above or the following:

T 497	3
TC 591	3

³Physical Chemistry/Thermodynamics—6 credits from the following:

CH 431	3	TC 441	3
CH 433	3	or TC 442	3
	6		6

⁴Humanities/Social Sciences Electives—University guidelines will be followed in that a minimum of 18 hours is required in addition to English 111 and 112. Selection will be from University approved lists with at least six hours from Humanities and six hours from Social Sciences. A Minimum of two electives in a graded sequence from the Social Science area and two courses in a graded sequence in the Humanities area is required. A graded sequence is defined as: a) a two-course sequence in which the first course is a prerequisite for the second; or b) a two course sequence in which the second course is at the 300 level or higher.

MINOR IN TEXTILE CHEMISTRY

The Textile Engineering, Chemistry, and Science Department offers a minor in Textile Chemistry to majors in any field except Textile Chemistry. The program is designed to expose students to the technical and scholarly disciplines of polymer chemistry, fiber formation, color physics, dyeing, and chemical modification of fabrics, and gives them an opportunity to learn how basic disciplines are applied in an industrial environment. Any interested student should contact the assistant department head of Textile Engineering, Chemistry, and Science for information about the minor and its prerequisites.

B.S. DEGREE IN TEXTILE ENGINEERING

(See Textile Engineering curriculum under College of Engineering.)

B.S. DEGREE IN TEXTILE MATERIALS SCIENCE

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chem. I	3	CSC 112 Intro. to Comp.	3
CH 121 General Chem. I Lab	1	ENG 112 Comp. & Reading	3
E 115 Intro. to Comp. Environ.	1	MA 241 Anly. Geom. & Calc. II	4
ENG 111 Comp. & Rhetoric	3	TC 203 Intro. to Polymer Chem.	3
MA 141 Anly. Geom. & Calc. I	4	Physical Education Elective	1
PE 100 Health and Physical Fitness	1		
TMS 106 Mod. App. in Text. Mat. Sci.	2		
	15		14

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 242 Anly. Geom. & Calc. III	4	MA 341 Appl. Diff. Equations I	3
PY 205 Physics Engr. Sci. I	4	MAE 206 Engineering Statics	3
TMS 211 Intro. Fiber Science	3	PY 208 Physics Engr. Sci. II	4
Humanities/Soc. Sci. Elective ¹	3	TE 201 Polymer & Fiber Sci. & Engr.	4
Physical Education Elective	1	Humanities/Soc. Sci. Elective ¹	3
	15	Physical Education Elective	1
			18

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 314 Solid Mechanics	3	ENG 331 Commun. Eng. & Tech.	3
TC 301 Tech. of Dyeing & Finishing	4	ST 361 Intro. Stat. for Engrs.	3
TE 301 Textile Manuf. Process. I	4	TAM 380 Mgmt. & Cont. Text. Syst.	3
TMS 361 Phy. Prop. of Text. Materials	3	TE 302 Text. Manuf. Process. II	4
Humanities/Soc. Sci. Elective ¹	3	TMS 362 Geom. & Mech. Text. Mat.	3
	17		16

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TMS 465 Text. Composite Materials	3	TMS 472 Text. Mat. Design II	3
TMS 471 Text. Mat. Design I	3	Humanities/Soc. Sci. Elective ¹	3
Humanities/Soc. Sci. Electives ¹	6	Restricted Elective ²	3-4
Restricted Elective ²	3	Free Electives	6
Free Elective	3		15-16
	18		

Minimum Hours Required for Graduation 128

¹Humanities/Social Science Electives—18 hours in addition to ENG 111 & ENG 112. One Economics course is required. The remaining courses should be selected from the University approved humanities/social science electives list with a minimum of two electives in a graded sequence from the social sciences area and two courses in a graded sequence from the humanities area. A graded sequence is defined as: a) a two-course sequence in which the first course is a prerequisite to the second, or b) a two-course sequence in which the second course is at the 300 level or higher.

²Restricted Electives—6-7 hours; students have the option of selecting two courses from the following courses:

TT 406	3
TAM 330	4
T 401	3
T 402	3
TES 500	3
TES 505	3

³Prerequisite Requirements for All Textile Materials Science Students—Before a student in the Textile Materials Science Degree program is eligible to enroll in a 200 or higher level engineering course, the student must have earned a grade of "C" or better in ENG 111, MA 141, MA 241, PY 205, and CH 101 and have passed at least one humanities or social science course.



COLLEGE OF VETERINARY MEDICINE

O. J. Fletcher, *Dean*

R. B. Ford, *Associate Dean and Director of Veterinary Services*

D. R. Howard, *Associate Dean and Director of Academic Affairs*

J. H. Britt, *Associate Dean and Director of Graduate Studies & Research*

T. E. Hamm, *Director of Laboratory Animal Resources*

No specific undergraduate degree track is associated with a pre professional veterinary medicine program. However, faculty members from the College of Veterinary Medicine and the College of Agriculture and Life Sciences serve as advisors to undergraduate students enrolled and pursuing a baccalaureate program usually in a science related field. Pre professional course requirements are listed below. After completion of the required courses, students may be eligible to apply for the professional veterinary program. Course requirements may be changed annually and are determined by the Committee on Admissions in the College of Veterinary Medicine. For further information about admissions requirements and the professional program contact the College of Veterinary Medicine Office of Admissions, NCSU, 4700 Hillsborough St., Raleigh, NC 27695-8401, (919) 829-4200 or 4205.

Undergraduate applicants with interests in veterinary medicine enrolled in the undergraduate programs at North Carolina State University at Raleigh are expected to be pursuing a baccalaureate degree (to include the social science and humanities requirements in the appropriate curriculum). Minimum requirements and course stipulations for curriculum planning should be followed through each of the departments or schools offering the appropriate degree. It is the responsibility of the students and their pre-professional advisors to be knowledgeable of those requirements.

All courses listed below should be completed by the end of the spring semester and only 2 courses may be pending completion as of the January 1 deadline.

PRE-PROFESSIONAL COURSE REQUIREMENTS

	<i>Languages (6 credits)</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3
ENG 112 Composition & Reading	3
<i>Physical Sciences (34 Credits)</i>		
BCH 451 Elementary Biochemistry	3
CH 101 General Chemistry & CH 121 Lab	3.1
CH 107 Principles of Chemistry & CH 127 Lab	3.1
CH 221, 223 Organic Chemistry I, II	8
MA 131 Analytical Geometry & Calculus A or	
MA 121 Elements of Calculus	4
PY 211, 212 General Physics I and II	8
ST 311 Introduction to Statistics	3
<i>Biological Sciences (14-15 Credits)</i>		
ANS 204 Livestock Feeds and Feeding or		
ANS (NTR, PO) 415 Comparative Nutrition or		
NTR 301 Modern Nutrition	3.4
BS 100 General Biology	4
GN 411 The Principles of Genetics	3
MB 401 General Microbiology	4
<i>Humanities and Social Sciences (12 Credits)</i>		
Humanities Electives	6
Social Science Electives	6

PROFESSIONAL DEGREE PROGRAM & CAREER OPPORTUNITIES

Veterinary medicine is a science career dealing with the recognition, treatment, control and prevention of diseases in animals. Career options are unlimited and variable as animal health impacts upon the health and economic welfare of the nation. DVM candidates may select several career options upon graduation. Federal government, private industry, private practice, and research and teaching activities in a university setting are all possible for graduates and licensed doctors of veterinary medicine. Successful completion of the professional training program should prepare students for appropriate state licensing examination in the state of North Carolina and others. Persons interested in the professional courses offered may receive a brochure by contacting the College of Veterinary Medicine.

ANATOMY, PHYSIOLOGICAL SCIENCES AND RADIOLOGY

Professor A. L. Aronson, Head of the Department

Alumni Distinguished Professor: J. E. Smallwood

Burroughs Wellcome Professor: J. E. Riviere

Professors: K. B. Adler, R. A. Argenzio, A. A. Aronson, T. M. Curtin, N. C. Olson, J. E. Riviere, J. E. Smallwood, C. E. Stevens, C. S. Teng, D. E. Thrall; Adjunct Professors: A. R. Brody, L. M. Jones, B. A. Schwetz, R. Welsh; Associate Professors: S. A. Bai, H. M. Berschneider, C. F. Brownie, L. N. Fleisher, J. E. Gadsby, L. C. Hudson, R. E. Meyer, C. L. Robinette, P. L. Sannes, K. A. Spaulding, C. R. Swanson; Adjunct Associate Professors: W. J. Croom, Jr., T. E. Eling, J. J. Heindel, J. A. Raleigh, C. T. Teng, R. D. Voyksner; Assistant Professors: C. R. Berry, P. W. Hellyer, N. E. Love, B. P. Peters, I. W. Smoak; Adjunct Assistant Professors: M. W. Dewhirst, D. C. Dorman, S. H. Randell; Research Associate Professors: M. C. McGahan, N. A. Monteiro; Research Assistant Professor: P. L. Williams.

COMPANION ANIMAL AND SPECIAL SPECIES MEDICINE

Professor M. K. Stoskopf, Head of the Department

Professors: C. F. Abrams, C. W. Betts, E. B. Breitschwerdt, T. E. Hamm, D. R. Howard, J. N. Kornegay, C. M. McPherson, E. A. Stone, M. K. Stoskopf; Adjunct Professor: S. W. Crane; Associate Professors: C. E. Atkins, S. E. Bunch, D. J. DeYoung, K. Flammer, R. B. Ford, E. M. Hardie, J. Hinshaw, B. W. Keene, T. O. Manning, M. P. Nasaisse, E. J. Noga, R. L. Page, N. A. Watson, M. S. Young; Adjunct Associate Professors: D. I. Hammer, K. G. Kagan, M. R. Loomis, D. C. Richardson; Assistant Professors: D. E. Bevier, M. G. Davidson, E. C. Hawkins, G. A. Lewbart, S. G. Price, S. C. Roe, S. L. Vaden, B. J. Weigler, S. J. Wheeler; Adjunct Assistant Professors: H. M. Aberman, R. J. Bartlett, P. J. Gengo, B. D. Hansen, D. E. Harling, K. L. Joyner, R. L. Torgerson; Adjunct Instructor: P. S. Kuder; Research Assistant: M. C. McEntee.

FOOD, ANIMAL AND EQUINE MEDICINE

Professor M. C. Roberts, Head of the Department

Professors: H. J. Barnes, O. J. Fletcher, B. D. Harrington, W. D. Oxender, M. C. Roberts; Associate Professors: G. W. Almond, K. L. Anderson, K. F. Bowman, B. A. Breuhäus, D. G. Bristol, M. Ficken, E. Hunt, D. H. Ley, L. P. Tate, S. Van Camp, D. P. Wages, M. D. Whitacre; Adjunct Associate Professors: S. P. Galphin, L. L. Munger; Assistant Professors: W. Duckett, M. M. McCaw, D. L. Sellon, B. D. Stenning, C. Uhlinger; Visiting Professor: C. C. McLean; Visiting Assistant Professors: J. Carr, J. Deen, T. Jordan; Swine Extension Specialist: M. Morrow; Poultry Extension Specialist: D. V. Rives.

MICROBIOLOGY, PATHOLOGY, AND PARASITOLOGY

Professor L. Coggins, Head of the Department

Alumni Distinguished Professor: R. C. Dillman

Professors: H. A. Berkhoff, T. T. Brown, Jr., P. B. Carter, E. V. DeBuysseher, R. C. Dillman, B. Hammerberg, M. G. Levy, D. J. Meuten, D. J. Moncol, J. B. Stevens, W. Tompkins; Adjunct Professors: J. K. Atwell, R. Johnston, J. A. Popp; Professor Emeritus: E. G. Batts; Associate Professors: P. Cowen, J. M. Cullen, F. J. Fuller, C. B. Grindem, J. S. Guy, J. Levine, P. E. Orndorff, M. B. Tompkins, S. L. Tonkonogy; Adjunct Associate Professors: G. Boorman, G. R. Burleson, J. F. Hardisty, W. F. MacKenzie, R. R. Marunpot, E. E. McConnell, R. Pfeiffer; Assistant Professors: M. Pino, B. Sherry, D. Weinstock; Adjunct Assistant Professors: R. C. Cattley, J. Everett; Associate Faculty Members: J. J. Arends, S. M. Laster, M. Qurehi.



OTHER ACADEMIC AND ADMINISTRATIVE UNITS

Division of Undergraduate Studies

Nelson Hall

J. A. Anderson, *Dean*

T. E. H. Conway, Jr., *Assistant Dean*

Directors: F. B. Artis, R. A. E. Callanan, E. H. Fuller, A. F. Mann, W. D. Weston; *Associate Directors:* S. J. Matney, B. A. Solomon; *Assistant Directors and Coordinators:* A. S. Bell, J. B. Brown, Jr., K. W. Gattis, P. L. Goza, A. N. Haley, W. T. Holloman, III, J. J. Izzo, C. H. Mardon, M. A. Tetro, A. S. Ugbaja, T. C. Wall

The Dean of the Division of Undergraduate Studies has general responsibilities for providing and coordinating academic support systems for undergraduate students, developing and monitoring the general education requirements for all undergraduate curricula, coordinating undergraduate academic advising, supporting teaching effectiveness initiatives, and generating grant support for undergraduate programs. The Division is comprised of six units including the **Academic Support Program for Student Athletes**, **First Year Experience Program**, **Undergraduate Studies Tutorial Center**, **University Cooperative Education Program**, **University Transition Program**, and **University Undesignated Program**.

Graduate School

Peele Hall

D. W. Stewart, *Dean*

M. F. King, *Associate Dean*

R. S. Sowell, *Associate Dean*

T. Melton, *Interim Associate Dean*

The Graduate School provides instruction and facilities for advanced study and research in the fields of agriculture and life sciences, design, education and psychology, engineering, forest resources, humanities and social sciences, management, physical and mathematical sciences, textiles, and veterinary medicine.

The school is currently composed of more than 1,900 graduate faculty members within the ten colleges. Educated at major universities throughout the world and established both in advanced teaching and research, these scholars guide the University's graduate student body of some 4,200 men and women from all areas of the United States and about 90 other countries.

The faculty and students have available exceptional facilities including libraries, laboratories, modern equipment, and special research areas.

For a list of graduate degrees offered at NCSU and details on programs and admissions, consult the *Graduate Catalog*.

Military Education and Training

The Department of Military Science (Army ROTC), the Department of Aerospace Studies (Air Force ROTC), and the Department of Naval Science (Naval ROTC) are separate academic and administrative subdivisions of the institution. Students in the ROTC programs will receive free elective credit for Aerospace Studies (AS), Military Science (MS), or Naval Science (NS) courses up to the limit of free electives in their curriculum.

DEPARTMENT OF MILITARY SCIENCE (ARMY ROTC)

Professor: Lieutenant Colonel W. T. Sabata

Instructors: Major P. K. Roddel, Major S. H. Harrington III, Captain K. P. McMillen, Captain K. Sanders, Captain M. Lyons

Mission. The mission of the Army ROTC Program is to train college men and women to become commissioned officers in sufficient numbers to meet Active Army, Reserve, and National Guard requirements.

Program of Instruction. The Army ROTC program consists of a voluntary six-semester hour Basic Course (freshmen and sophomore level) and a two-year Advanced Course (junior and senior level) which includes a six week camp in the summer prior to the senior year.

One may enter the Advanced Course without participating in the Basic Course by any of the following methods:

SIMULTANEOUS MEMBERSHIP PROGRAM (SMP): Members of Reserve or National Guard units may take advantage of this program and, if accepted, enroll directly into the Advanced Course. SMP participants will be assigned to a unit near NCSU or home for part time monthly officer training and will receive the ROTC Advanced Course subsistence payment of \$100 per month, plus approximately \$120 per month for the one weekend of Reserve or Guard training. In addition, two weeks of Annual Training will be required for which the individual will receive full pay.

PRIOR SERVICE: Service veterans are eligible for placement into the Advanced Course.

BASIC SUMMER CAMP: Successful completion of the six week basic summer camp, held at Ft. Knox, Kentucky, is an alternative to the basic course.

TRANSFER CREDIT: Students entering as transfer students from other institutions may receive credit for work completed at other Senior ROTC units.

JUNIOR ROTC: Students who have participated in a Junior ROTC in high school may receive placement credit as determined by the Professor of Military Science.

Eligibility: All full time freshmen and sophomores may enroll in any Military Science Basic Course offering without obligation to the Army. To be eligible for participation in the Advanced Course, applicants must be in good academic standing and demonstrate satisfactory performance in the Basic Course. Additionally, applicants for commissioning must be able to be commissioned by their 30th birthday; however, an age waiver may be obtained as long as the individual will be commissioned prior to his or her 34th birthday. A student must have a minimum of two years remaining as a full time student at either the undergraduate or graduate level.

Professional Military Electives: There are seven Professional Military Electives which must be taken or an approval obtained of a waiver for them. These electives must be completed or waived prior to commissioning.

Delays for Graduate Study: Qualified ROTC graduates may delay their entry into active service in order to obtain advanced academic degrees. Fellowships for advanced academic study are available to selected ROTC graduates, allowing up to two years of graduate study while receiving full pay and allowances plus payment for tuition, all fees, textbooks and required supplies.

Financial Aid: Army scholarships of two to four years which pay for tuition, all fees and textbooks are available on a competitive basis to students who are strongly motivated and

academically qualified. Students in the Advanced Course who are preparing for a commissioning receive a subsistence allowance of \$100 per month (tax free) up to a maximum of \$2000. All Advanced Course cadets are paid approximately one half the basic pay of a second lieutenant, while attending the six-week Advanced Camp, plus travel allowances to and from camp.

Service Opportunities: Scholarship recipients may serve four years active duty upon commissioning or eight years in the United States Army Reserve or National Guard. Nonscholarship commissionees must serve three years on active duty or eight years with the Army Reserve or National Guard. Service consists of one weekend drill per month and two weeks annual training.

Program Features: Army ROTC classes are unique, offering instruction and a practical, working knowledge of leadership. Students are challenged early in their ROTC training to enable them to develop sound judgement, the desire to achieve, acceptance of responsibility, personal confidence, and to learn the principles of personnel management. The primary vehicle for this training during the academic year is Leadership Laboratory, where cadet officers and non-commissioned officers conduct instruction under the supervision of the Military Science Department's faculty. The intensive summer Advanced Camp is extremely effective in developing one emotionally, mentally and physically. All Army ROTC training is focused on preparing the student to meet the challenges of tomorrow's society, whether in a military or civilian career.

Distinguished Military Students: The University names outstanding Army ROTC students as Distinguished Military Graduates.

Uniforms: Uniforms for Army ROTC are provided by the federal government.

DEPARTMENT OF AEROSPACE STUDIES (AIR FORCE ROTC)

Professor: Colonel R. H. Haden

Instructors: Major F. P. Dunlap Jr. Captain R. Iseman, Captain C. L. Casey

Program. There is a four-year and a two-year program that leads to a commission in the United States Air Force.

The four year program allows freshmen to enroll in Aerospace Studies courses in the same manner as other college courses for the first two years. Students take these courses as free electives and incur no military obligation unless they are receiving an AFROTC scholarship. These first two years are called the General Military Course (GMC). The last two years of AFROTC comprise the Professional Officer Course (POC). Non AFROTC sophomore students may compete with GMC cadets for a position in the POC and obtain a commission under the two-year program.

The two-year program is available to those who do not take the first two years of Air Force ROTC. Interested students must contact the Professor of Aerospace Studies early in the first semester of their sophomore year. Accepted students will attend a six-week summer field training encampment (two-year program) or a four week encampment (four-year program) before entering their junior year and the POC.

Students with a pilot allocation usually attend a flight instruction program during the summer following their junior year. This training is very similar to that available for obtaining a private pilot's license. Junior cadets may also apply for other special summer voluntary programs such as USAF Academy Freefall Parachute Training, British (RAF) Exchange Program, Army Airborne Training Program, Strategic Defense Initiative R & D Program, and other specialized professional development programs related to the cadet's future career area.

Upon graduation and satisfactory completion of the POC, the student is commissioned a second lieutenant in the USAF.

Financial Aid. Air Force ROTC students are encouraged to apply for scholarships for two or three years. Scholarships pay for tuition, fees, books, and provide students \$100 per month during the academic year for miscellaneous expenses. Scholarships are awarded by the Air Force based primarily on college academic achievement.

Students in the GMC, other than scholarship students, receive no monetary allowance. All POC students receive the \$100 per month during the academic year.

Curriculum. The AFROTC educational program provides professional preparation for future Air Force officers. During the first two years, courses will focus on a detailed study of the Air Force mission and organization, other military services, the evolution of Airpower concepts and doctrine, and the history of Airpower employment. During the last two years, the focus will be on leadership and management and an in-depth examination of National Security, American defense strategy and policy, and the methods for managing conflict. Throughout all four years a progressive development of communicative skills is integrated into each course. Officership is developed through leadership laboratory, traditional military social functions, base orientation trips, and cadet-centered programs.

Eligibility. There are no enrollment requirements for the GMC. To enter the POC students must pass an Air Force Officer Qualifications Test, meet physical and academic requirements, and be selected by the Professor of Aerospace Studies and Air Force ROTC headquarters. In addition, students must complete their degree and the POC before their 30th birthday. Veterans may obtain a waiver of maximum nonflying age requirement up to age 35.

Students desiring to enter the four-year program simply register for the freshmen Aerospace Studies course. Other students should contact the ROTC office on campus in Room 141 Reynolds Coliseum; or write to: Professor of Aerospace Studies, NCSU, Box 7308, Raleigh, North Carolina 27695-7308.

Organization. The AFROTC unit is organized as a cadet wing staffed entirely by cadets for leadership development. They are assisted and advised by the instructors. Two collateral organizations, Arnold Air Society and Angel Flight support the wing organization as well as the University.

Uniforms. Uniforms are provided by the federal government.

NAVAL SCIENCE (NAVAL ROTC)

Professor: Captain R. B. Avery

Associate Professor: LCDR Walter Neboshynsky. *Instructors:* Major Thomas L. Cariker, Lieutenant Julie M. Johnson, Lieutenant Stephen Shingee

Mission. The purpose of the Naval ROTC Program is to provide a source of highly qualified and motivated naval officers, both men and women, to serve on surface ships, in aircraft, in submarines, or in the Marine Corps.

4-Year NROTC Program. There are basically two NROTC Programs leading to a commission as a Navy or Marine Officer upon graduation, the Scholarship Program and the College Program.

Scholarship Program. The Scholarship Program leads to a commission in the Navy or Marine Corps. For students who receive a Navy/Marine Corps scholarship, the Navy will pay tuition and fees, buy books, supply uniforms, and pay \$100 per month tax-free subsistence allowance to help defray the cost of normal board at the University. During the summers between school years scholarship students will receive 4-6 weeks of at sea training conducted on ships, submarines, and aircraft of the Navy's first line force. Upon graduation and commissioning, scholarship students are obligated to serve a minimum of four years on active duty.

College Program. For those students who are interested in a commission and do not desire a scholarship, or for those who are seeking an opportunity to qualify for a scholarship after entering NCSU, the College Program is available. Selection for the College Program is made from students already enrolled at NCSU, with applications being accepted and considered by the staff of the NROTC unit. Students enrolled in the College Program are provided uniforms and Naval Science textbooks. College Program students compete for selection to continue NROTC in Advanced Standing at the end of their sophomore year. Selection is based on academic and demonstrated professional performance. Those selected for Advanced Standing receive \$100 per month subsistence allowance during the final two years of the program. College Program midshipmen receive a single summer training cruise between the junior and senior year. Except for administrative differences, no distinction is made between the Scholarship and College Program midshipmen. The min-

imum active duty commitment following graduation for a College Program student is three years.

Students in the College Program are eligible to compete for scholarships at regular intervals. Most College Program students who have demonstrated above average academic and professional performance in the unit have received scholarships.

Two-Year Programs. The Two-Year Programs offer an opportunity to participate in NROTC during the final two years of University study. Both Scholarship and College Programs exist, offering the same advantages to the student having two years of college remaining as the respective four year programs. Applications for this program must be completed by March 15 prior to the starting year. Upon selection, the candidate attends a six week training course at Newport, Rhode Island, during the summer between the sophomore and junior years so that he or she may receive instruction in the Naval Science subjects normally covered in the first two years at the University. Participants in this training course receive uniforms, room and board, and officer candidate pay during the period and, upon satisfactory completion of training, enter the NROTC program as third year students. The application process can be time consuming. In order to meet the March 15 deadline, students are encouraged to contact the Department of Naval Science before December 1 of their sophomore year.

The Marine Option. A limited number of quotas are available for students who wish to enter either of the NROTC Programs as Marine Officer candidates. For others who may decide upon a Marine Corps commission after joining NROTC, selection for the Marine Option may be made in the sophomore year. A midshipman's status as a Marine Option will result in some modifications to the curriculum and the final summer training period.

Curriculum. Due to the increasingly advanced technologies being employed by the Navy and Marine Corps, candidates for Navy Commissions are encouraged to select academic majors in mathematics, engineering, or scientific disciplines. However, each student in the NROTC program is free to choose his or her area of major study.

The NROTC training program emphasizes academics, leadership, military organization, and physical fitness. Required Naval Science courses are fully accredited, taken for free elective credit and include Naval Orientation, Engineering, Weapons Systems, Navigation, Naval Operations, and Leadership and Management. Marine Option midshipmen substitute Evolution of Warfare and Amphibious Warfare for selected courses. Additional University courses may be required depending upon one's major; however, all Navy option scholarship midshipmen must complete one year of calculus and physics. In addition to the courses taken for University credit, midshipmen will attend one leadership laboratory period each week.

Midshipmen Life. Academic excellence is emphasized throughout the NROTC Program with commensurate participation in the full range of campus extra curricular activities. The NROTC unit is organized as a midshipmen battalion to facilitate leadership development. The battalion is staffed entirely by midshipmen under the supervision of staff instructors. Additionally, midshipmen have opportunities to examine all aspects of life in the Navy and Marine Corps and gain leadership experience through field trips, summer cruise, sail training, and social activities. Further information regarding application for and admission into the N.C. State Naval ROTC may be obtained on campus in Room 102 Reynolds Coliseum or by writing to the Professor of Naval Science, Box 7310, NCSU, Raleigh, North Carolina 27695 7310 or by calling (919) 515-2757/6216.

Music Department

Price Music Center

R. J. Toering, *Director of Music*

Assistant Directors: F. M. Hammond, J. C. Kramer, M. S. Lynch, R. B. Petters, A. E. Sturges, P. H. Vogel, E. B. Ward
Artist in Residence: filled by a new appointment each year

The Music Department at NCSU is committed to providing students with a broad based education that not only prepares students for a career but also supplies them with aesthetic values that stimulate creative activities and enrich their personal lives. Through a variety of musical experiences, the department seeks to help students develop their musical insight, improve their musical skills, and cultivate their ability to perceive and respond to the beauty of music and the excitement it brings to life.

Opportunities for direct student participation as performers include many instrumental and choral organizations, which are described in more detail under "Student Activities." Membership in any musical organization is open to students with a disciplined interest in music. Auditions are scheduled during orientation activities, at the beginning of each academic semester, and by personal appointment with directors of particular musical organizations. For further information, please consult the Music Office.

Academic credit as well as aesthetic appreciation are available through a large number of courses, most of which may be taken to fulfill humanities elective requirements in any undergraduate curriculum. Any of these courses may be taken as free electives. Music Department courses are described in greater detail in the "Course Description" section of the catalog under the MUS course prefix.

The department also serves as a cultural resource for the University community and the public at large through a variety of concerts presented by student musical organizations, departmental performers, and visiting artists. Concerts are open to all students free of-charge.

Office of Research, Outreach, and Extension

W. L. Klarman, *Interim Vice Chancellor for Research, Outreach, and Extension*

S. L. Kirsch, *Associate Vice Chancellor for Outreach and Extension*

C. G. Moreland, *Interim Associate Vice Chancellor for Research*

The Vice Chancellor provides leadership for research, outreach and extension programs for the entire University. The Office of Research, Outreach and Extension provides administrative support and services, in technology transfer, grants and contracts, multi-disciplinary projects, lifelong education and professional development; promotes the transfer and use of technology and new knowledge to ensure a better quality of life for the people of the State, the nation and the world in response to public needs and societal problems.

DIVISION OF CONTINUING STUDIES

S. L. Kirsch, *Associate Vice Chancellor for Outreach and Extension*

Campus-wide coordination and communication for continuing education and distance learning are provided through the Division of Continuing Studies. In carrying out these responsibilities, the division provides assistance in the identification of educational needs for non-traditional students, professionals, business, industry, and governmental agencies.

Through its numerous credit and non-credit programs and courses, the division facilitates bringing together the educational needs of the people of North Carolina with the intellectual resources of the University. The division includes the following four units:

ADULT CREDIT PROGRAMS AND SUMMER SESSIONS

J. F. Cudd, *Director*

The **Office of Adult Credit Programs** registers and provides student services to Undergraduate Studies (UGS) and Post-Baccalaureate Studies (PBS) students who enroll in the University's regularly scheduled day and evening classes. These non-degree students may take any course offered by the University, provided they satisfy any required prerequisites and space is available. Late afternoon and evening courses are offered primarily for the benefit of adults who are unable, because of time limitations, to attend day courses. Each semester, over 350 afternoon and evening courses are offered in over 50 subject areas. Twelve undergraduate and twelve graduate degrees may be completed by individuals enrolled solely in evening classes. Approximately 4,000 UGS and PBS students enroll each semester.

Using a variety of delivery systems, classes are offered across the state and throughout the United States. Methods include traditional, face-to-face instruction, as well as courses offered by various telecommunication mechanisms including satellite delivery, videocassette, and cablevision. Total enrollment in off campus credit courses for 1991-1992 was 2,770.

More than 30 courses in 17 subject areas are offered through the Independent Studies (correspondence) Program. Administration of the program is handled by the Office of Independent Studies of the Division of Extension and Continuing Education at UNC Chapel Hill.

The **Summer Sessions** at NCSU offer an extensive educational program planned to meet the varied needs and interests of approximately 15,000 students. Sixty-seven departments offer instruction in more than 800 courses, approximately 90% of which are at the undergraduate level. Each of the University's ten colleges and schools, with a combined faculty of more than 600, participates in the summer sessions. The schedule includes two "regular" five week sessions, a ten-week session, and a three-week institute for adult and extension educators, as well as several dozen evening courses scheduled for the convenience of working adults.

Summer courses and special programs are designed for the new student, the undergraduate wanting to advance his or her academic standing at NCSU, the graduate desiring to continue study and research during the summer months, and visiting students pursuing degrees at other institutions. Teachers who need to earn credit toward renewal of teaching certificates or advanced degrees in education and persons in professional fields who wish to keep abreast of new developments and trends also take advantage of NCSU's summer programs.

For information regarding summer activities write: Director of Summer Sessions, Box 7401, NCSU, Raleigh, North Carolina 27695 7401.

CONTINUING EDUCATION AND PROFESSIONAL DEVELOPMENT

E. B. Marston, *Director*

Assistant Director: A. S. Warren; *Continuing Education Specialists:* C. Bacon, M. McKenzie, B. Quick

In keeping with the land grant tradition of the University, the Office of Continuing Education and Professional Development offers education and training to all the people. Programs include: agriculture, communication, data processing, economics, education, engineering, forestry, management, the physical sciences, recreation, textiles, and veterinary medicine. Special efforts are made to meet the training needs of industry and

government agencies. More than 500 courses are offered with registrations totalling over 25,000.

The University awards Continuing Education Units to participants in qualified programs. Continuing Education Units are part of a nationwide recording system to provide a uniform measure of attainment in noncredit educational programs. One CEU is defined as "ten contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction and qualified instruction."

INSTRUCTIONAL TELECOMMUNICATIONS

T. L. Russell, *Director*

Selected credit courses, graduate and undergraduate, are delivered off campus to individuals and groups by means of several different television technologies - cable, microwave (MCNC CONCERT), satellite and videocassette. Degrees and certificates are available through one or more of these technologies. Depending on the television technology employed, courses, degrees, and certificates are available in the Raleigh/Wake County area while others are provided state-wide, nation wide, and even globally. NCSU colleges utilizing television to reach distant students include Agriculture and Life Sciences, Design, Education and Psychology, Engineering, Humanities and Social Sciences, Management, Physical and Mathematical Sciences, and Textiles.

ENCORE CENTER FOR LIFELONG ENRICHMENT

D. S. Jackson, *Director*

Encore, a member-supported program of lifelong enrichment for people over 50, develops and presents a variety of learning experiences: non credit courses, colloquia, special study trips, and a fitness program. The program was developed during the 1990-91 fiscal year in response to the growth rate of third-age learners in the overall Raleigh-Wake County population. The integrity of Encore comes not only from the guidance of the Division of Continuing Studies but also from the older adults whose needs, interests, ideas, and experiences have given direction to Encore's mission of educational stimulation, personal enhancement, and community service.

EMERGING ISSUES FORUM

B. Owen, *Director*

The Emerging Issues Forum provides an important arena for bringing together top-level leaders from government, business, education, and the scientific community to discuss and debate the most critical issues of our time, to question conventional wisdom, and to test new ideas. The forum supports NCSU's unique role in relation to major American industries by serving as a catalyst for framing questions and suggesting answers in the world arena of economic and technological developments. The forum generates the kind of public policy debate that relates to jobs, opportunities, education, and quality of life and, at the same time, the forum endorses as top national priorities the concepts of innovation and competitiveness.

CENTER FOR URBAN AFFAIRS AND COMMUNITY DEVELOPMENT

Y. S. Brannon, *Director*

The Center for Urban Affairs and Community Services brings the research, educational, and extension resources of NCSU to bear upon community problems associated with urbanization in North Carolina. In addition to providing direct services, such as applied research, education, and technical assistance, to local and state governments in the areas of social sciences, human services, policy analysis, and evaluation research, the center also: (1) provides experiential educational opportunities for graduate and undergraduate students

and (2) develops and supports research opportunities for faculty and upper-level graduate students.

The Center for Urban Affairs and Community Services coordinates its work with other members of the University of North Carolina's Urban Studies programs through the Urban Studies Council. The council enables universities and other institutions across the state to pool their efforts to encourage productivity and responsiveness of government and community institutions.

JANE S. McKIMMON CENTER FOR EXTENSION AND CONTINUING EDUCATION

J. R. Quick, *General Manager*

The Jane S. McKimmon Center serves as the premier adult education facility in North Carolina. It provides program support services in pleasant surroundings conducive to the interchange of ideas and information. In the sixteen years since opening in June, 1976, the center's sixteen conference rooms have been used for 16,725 educational meetings bringing a total of 1.14 million adults from all walks of life to our campus for participation in an education activity.

BIOTECHNOLOGY PROGRAM

M. A. Conkling, *Director*

The Biotechnology Program at NCSU includes some 70 faculty representing seventeen Departments in the Colleges of Agriculture and Life Sciences, Engineering, Forest Resources, Physical and Mathematical Sciences, and Veterinary Medicine. The Program administers a Ph.D. minor in Biotechnology that may be taken by students who reside and conduct their research in one of the participating departments. To minor in Biotechnology, the student must complete at least six credit hours of biotechnology laboratory courses and must conduct graduate research in the area of biotechnology. Research in biotechnology is multidisciplinary encompassing three main areas: molecular biology, bioprocessing bioanalytical techniques, and in vitro cell culture.

SEA GRANT COLLEGE PROGRAM

B. J. Copeland, *Director*

The University of North Carolina Sea Grant College Program is a state/federal partnership program involving all campuses of the UNC system. A majority of its activities, however, are conducted at NCSU. Sea Grant combines the University's expertise in research, extension, and education to focus on practical solutions to coastal problems. Graduate and undergraduate research opportunities rest with individual project directors on campus and with a special fellowship program administered by the program office.

WATER RESOURCES RESEARCH INSTITUTE

D. H. Moreau, *Director*

The Water Resources Research Institute is a unit of the University of North Carolina System and is located on the campus of NCSU.

The institute was established to promote a multi-disciplinary attack on water problems, to develop and support research in response to the needs of North Carolina, to encourage strengthened educational programs in water resources, to coordinate research and educational programs dealing with water resources, and to provide a link between the state and federal water resources agencies and related interests in the University.

Research and educational activities are conducted through established departments and schools of the university system. All senior colleges and universities of North Carolina are eligible to participate in the institute's research program.

MATERIALS RESEARCH CENTER

R. F. Davis, *Director*

The Materials Research Center was established in 1984 at NCSU as an interdisciplinary program involving persons representing the Departments of Chemistry, Electrical and Computer Engineering, Materials Engineering, and Physics. The principal thrust area of the center involves fundamental studies in the epitaxy of compound semiconductors. The center serves as a focal point for this cooperative research. However, the experimental efforts are conducted within the four departments noted above.

University Libraries

S. K. Nutter, *Director*

D. S. Keener, *Associate Director for Administrative Services*

S. S. Striedieck, *Associate Director for Technical Services and Collection Management*

C. L. Gilreath, *Associate Director for Public Services*

J. Y. Davis, *Assistant Director for Planning and Research*

J. E. Ulmschneider, *Assistant Director for Library Systems*

The NCSU Libraries consists of the D. H. Hill Library and five branch libraries. It contains more than 1.4 million volumes of books and bound journals, 800,000 federal government publications, and more than 3 million microforms. The collections are particularly strong in the biological and physical sciences, engineering, agriculture, forestry, textiles, and architecture, with the arts, humanities, and social sciences also well represented. The Libraries regularly receives nearly 17,000 serials. Five special libraries - the **Burlington Textiles Library** in the College of Textiles complex, the **Harry B. Lyons Design Library** in Brooks Hall, the **Natural Resources Library** in Jordan Hall, the **Veterinary Medical Library** in Veterinary Medical Building and the **Learning Resources Library** in Poe Hall - serve the special needs of their respective school and colleges.

The NCSU Libraries has been a depository for U.S. government publications since 1924 and receives over 88 percent of these publications. Beginning in 1992 the Libraries was designated a full depository for North Carolina government documents. The Libraries also receives the microfiche research reports published by the Department of Energy, the National Aeronautical and Space Administration (NASA), the Educational Resources Information Center (ERIC), and the National Technical Information Service (NTIS).

The online, computer-based author, title, and subject catalog permits rapid identification of monographs and serials in the collections of the NCSU Libraries as well as those of Duke University and UNC Chapel Hill. This resource sharing greatly enhances the research capabilities of the NCSU Libraries. This is made possible through the Libraries' participation in the Triangle Research Libraries Network (TRLN). An automated circulation system provides quick, easy check out of books by borrowers.

A number of bibliographic and full text databases are available in CD ROM format for searching by users at no charge. They cover fields such as engineering, agriculture, education, business, and patent literature. In addition, the Libraries provides staff-assisted searching of hundreds of other online databases on a cost-recovery basis.

Facilities and equipment are also available for both individual and group use of audiovisual media. The D. H. Hill Library's theatre and group viewing rooms can be scheduled for presentations. The library has a growing collection of video, audio, and multimedia titles for individual and class use, and films in the State Library's film collection can be borrowed for academic use by faculty and students. The Media Center is also equipped with audio and video equipment in carrels for group and individual viewing and listening.

LEARNING RESOURCES LIBRARY

M. A. Link, *Coordinator*

C. A. Cranford, *Assistant Coordinator*

The Learning Resources Library, administered by the College of Education and Psychology, is located in 400 Poe Hall. The library maintains a collection of education materials with particular emphasis on teaching methods, research, administration and psychology and includes films, filmstrips, slides, audiotapes, video cassettes, videodiscs, simulation games, and computer software. Audiovisual equipment is available for previewing materials in the library. The library acquires textbooks adopted by the State Board of Education for secondary level subjects as well as other selected textbooks and reference materials. The mission of the library is to support programs in the College of Education and Psychology. Lending policies permit the use of certain materials by the larger campus community for instructional and research purposes.

University Computing

C. W. Malstrom, *Interim Associate Provost for Academic Computing Services*

H. L. Buckmaster, *Director, Administrative Computing Services*

C. W. Malstrom, *Director, Computing Center*

The Computing Facilities at NCSU include a major mainframe installation and a large collection of workstation and microcomputer resources, both in the central facilities of the Computing Center, and distributed on campus, serving the academic and administrative functions of NCSU. These components are interconnected by a comprehensive data communications network which connects to the Concert, Bitnet, Internet and usenet networks. NCSU is also a participant in the North Carolina Supercomputing Center, in the Research Triangle Park, which is on the Concert network and which has a CRAY Y-MP supercomputer, a Convex C-2 mini-supercomputer, an IBM 3090 170J, and extensive visualization facilities.

The major computers in the Computing Center are an IBM 3090 180J shared between academic computing and administrative data processing and DEC VAX8700 computer for academic use. The Computing Center also provides a large selection of central services including terminal facilities, consulting, user support from supercomputers to microcomputers, data communications, networked information services, and repair facilities for microcomputers and terminals. The Computing Center is a Smart Node of the Cornell National Supercomputer Facility. The Computing Center has responsibility for several data communications networks including an optical fiber FDDI backbone, a broadband cable system, a data switch, a video distribution switch, various other low, medium, and high speed communication media.

All of these facilities, and other networked resources including the library on-line catalog and a campus information resource, can be reached via dial up lines and over the data communications networks provided on the campus. Access can be via data terminals and by personally owned microcomputers which are also used by themselves for word processing, scientific computation, etc.. The NCSU Bookstores provide an opportunity for students to purchase microcomputers and software at low academic prices.

Additionally, many departments provide student access to networked microcomputers and workstations. Particularly notable is Project Eos in the College of Engineering, which is integrating NCSU provided engineering computing workstations into undergraduate education.

Research Triangle

The unique "Research Triangle" in North Carolina has captured national and international attention. It is comprised of the Research Triangle Park, a world renowned research park, and three major research universities. Because of this wealth of educational and research opportunities, the Triangle area contains the highest total of Ph.D. scientists and engineers per capita, in the nation. The Triangle universities - NCSU, the University of North Carolina at Chapel Hill, and Duke University - have a subsidiary campus in the Research Triangle Park - the Research Triangle Institute. The Institute, which operates as a contract research organization, has an annual research revenue of approximately \$112 million.

The Research Triangle Park, founded in 1959, now has more than 59 public and private industrial research facilities, situated on 6,800 acres of land. Over 34,000 people work in the Park and over 30,000 additional jobs have been created outside the Park as a result of its existence. Organizations in the Park include such government facilities as the National Humanities Center, the National Institute of Environmental Health Sciences, the Environmental Protection Agency, and the National Center for Health Statistics. Private companies such as Glaxo Pharmaceuticals, Northern Telecom, and Reichhold Chemicals have their North American headquarters in the Park. Two major, state supported research initiatives in Microelectronics and Biotechnology are located in the Park and North Carolina's Supercomputing Center is housed there as well. Faculty and graduate students from the universities work closely with many of the Park companies. Scientists and researchers from companies like Burroughs Wellcome, IBM, and Becton-Dickinson frequently hold adjunct appointments in one or another of the Triangle Universities.

Research Centers and Facilities

BIOLOGY FIELD LABORATORY

P. D. Doerr, *Director*

The Biology Field Laboratory is located six miles from the University campus and comprises two small streams, a 20 acre pond, 50 acres of varied terrestrial habitats and several laboratory buildings. Three hundred and fifty adjacent acres of timbered watershed managed by NCSU in cooperation with the State Forest Service are also available for similar uses. The facilities, used for laboratory and field instruction and for undergraduate, graduate, and faculty research, are particularly suited for use by advanced classes in several biological science departments from the Colleges of Agriculture and Life Sciences and Forest Resources.

CENTER FOR ADVANCED ELECTRONIC MATERIALS PROCESSING (AEMP)

N. A. Masnari, *Director*

The Center for Advanced Electronic Materials Processing was established in 1988 as one of the prestigious NSF Engineering Research Centers. The center's program is interdisciplinary and involves collaboration among chemists, physicists, materials scientists, and electrical, chemical, computer, and mechanical engineers. The research focuses on the development of electronic materials processing technologies that will provide the capability of producing submicron electronic devices. The program emphasizes low-temperature processes using plasma and thermal and optically assisted techniques as well as the automation and control of those processes. It is a joint effort with researchers from the University of North Carolina (Chapel Hill and Charlotte), Duke University, North Carolina A&T State University, Research Triangle Institute, and Microelectronics Center of North Carolina (MCNC).

CENTER FOR ASEPTIC PROCESSING AND PACKAGING STUDIES

K. R. Swartzel, *Director*

The Center for Aseptic Processing and Packaging Studies was established in October 1987 to promote cooperative research between University and industrial researchers and to further scientific knowledge in areas of food and pharmaceutical aseptic processing and packaging. The center is funded by the National Science Foundation, NCSU, and industrial members from food, pharmaceutical, and packaging industries. The objectives of the center are to support industrially relevant, fundamental research in aseptic processing and packaging; to enhance product quality and improve efficiency; and to communicate information gained from basic research to industry for development and marketing.

Students working on CAPPS projects will be exposed to industrial concerns and given the opportunity to work first-hand with industry in solving problems and making practical application of their research. Present research is conducted in the Departments of Food Science, Biological and Agricultural Engineering, and Chemical Engineering at NCSU. Cooperative research opportunities are also available at other universities.

CENTER FOR COMMUNICATIONS AND SIGNAL PROCESSING

G. Abbott, *Director*

A. A. Nilsson, *Technical Director*

In 1981, the National Science Foundation selected NCSU as a site for an industry university cooperative research Center for Communications and Signal Processing (CCSP). As of June 1992, CCSP members include BellSouth Enterprises, Inc., Eastman Kodak Co., General Electric Co., International Business Machines, JIEO, MCNC, USA-CECOM and USA-STRICOM. CCSP has achieved national and international recognition as a center of excellence in communications and signal processing research. The objectives of the center are to conduct basic and applied research that can lead to products and services in the communications and signal processing fields and to strengthen industry university relationships. In addition to providing useful research services to industrial participants, the center enhances the education of graduate students by providing them with practical, relevant research topics and the means for carrying out their research.

CENTER FOR RESEARCH AND DEVELOPMENT IN MATHEMATICS AND SCIENCE EDUCATION

S. B. Berenson, *Director*

The center, one of ten centers in the North Carolina Mathematics and Science Education Network, is the only research and development center in the network. Established within the Department of Mathematics and Science Education in 1984, the center conducts research and development activities for precollege students, preservice teachers, inservice teachers, and University faculty. The center identifies areas of need in mathematics and science education and forms partnerships with federal, state, local and private funding agencies to work collaboratively to address the needs. Grants have been obtained from the National Science Foundation, Office of Education, State Department of Public Instruction, Local Education Agencies, the Ford Foundation, and IBM to introduce changes that incorporate technology and active learning into the mathematics and science curriculum, K-16. In addition, the center supports graduate students and provides them with opportunities to write grants and to design, conduct, and report on educational research.

CENTER FOR SOUND AND VIBRATION

R. T. Nagel, *Director*

The Center for Sound and Vibration, established in 1969 and administered within the Department of Mechanical and Aerospace Engineering, comprises faculty pursuing the

solution to a wide variety of vibration and acoustic problems occurring in machinery and aircraft design. Graduate programs exist at M.S. and Ph.D. levels in such fields as noise and vibration control, structural acoustics, aeroacoustics, hearing conservation, computer-aided machinery design, architectural and musical acoustics, and acoustic signal processing. Outstanding experimental facilities, which include large anechoic and reverberant rooms and computer graphics equipment, are available. The center's programs are financed largely by grants and contracts from industry and federal and state agencies.

ELECTRIC POWER RESEARCH CENTER

J. J. Grainger, *Director, Electrical Area*

P. J. Turinsky, *Director, Nuclear Area*

W. E. Vickery, *Executive Director*

The Electric Power Research Center, established in 1985 within the NCSU College of Engineering, is supported via membership fees, enhancement grants, and normal research contracts by organizations from the various sectors of the electric utility and power industry, including national laboratories and private interests. The purpose of the center is to collaborate in enhancing the excellence of a wide range of research and graduate-level degree programs in electric power systems from power generation to end usage. This primary purpose is accomplished by supporting interested faculty and students' involvement in basic and applied research directly relevant to the needs of the multifaceted electric power industry. Motivation to work with the center derives from the close University membership interaction, the leverage afforded members via pooled resources, and the enhanced professional and research opportunities provided to faculty and students in electric power engineering.

The current research program involves faculty from the Department of Nuclear Engineering and the Department of Electrical and Computer Engineering. However, the center facilitates access by all sectors of the electric power industry to the various resources of the University.

ELECTRON MICROSCOPE FACILITIES

There are four electron microscope facilities at NCSU available to graduate students and faculty for research purposes. The College of Agriculture and Life Sciences Center for Electron Microscopy is located in Gardner Hall, the Engineering Research Microscope Facility is in Burlington Engineering Labs and the Department of Wood and Paper Science Electron Microscopy Lab is in Biltmore Hall. The new SVM Electron Microscopy Laboratory is located in the NCSU School of Veterinary Medicine at 4700 Hillsborough Street in Raleigh.

J. M. MacKenzie, Jr., *Coordinator, CALS Center for Electron Microscopy*

The CALS Center for Electron Microscopy has two transmission electron microscopes: a Philips 400T with STEM capabilities and equipped with a computer control system and a JEOL 100S. There are also two scanning electron microscopes - a Philips 505T and a JEOL T300, both of which can be computer controlled. All four electron microscopes are used in teaching and/or research. The Center is fully equipped for a range of biological specimen preparations, has two printing darkrooms, and offer complete service support in all areas of biological electron microscopy.

Formal graduate level instruction is provided through the biological sciences curriculum in sample preparation, use of the electron microscopes, and production of electron micrographs. Training in advanced techniques is provided on an individual basis.

P. E. Russell, *Director, Engineering Analytical Instrumentation Facility*

The Engineering Research Analytical Instrumentation Facility (AIF) provides NCSU faculty and students the best of the modern microanalysis instrumentation cur-

rently available as well as trained specialists to assist with instrument operation and experimental design. AIF is equipped with seven major research tools for the examination of metallurgical, ceramic, electronic and other materials. A Scanning Auger Microprobe (JEOL JAMP-30) and a Secondary Ion Mass Spectrometer (Cameca IMS 3F) provide surface analytical capability. The scanning auger microprobe is capable of surface analysis of the top three atomic layers of a solid material with a lateral resolution of 50 to 100 nanometers. In addition, the auger microprobe, equipped with an argon ion gun, provides in depth profiling analysis through thin films. The secondary ion mass spectrometer can perform elemental and isotope analysis to monolayer depths with part per million sensitivity and with lateral resolution of 1 micrometer. This system can also provide in depth profiling analysis which is especially important for implanted semiconductor analysis. Three 200KV transmission electron microscopes (a Hitachi H-800 Scanning Transmission Electron Microscope [ASTEM], a Topcon 002B high resolution Transmission Electron Microscope, a Topcon 002B Analytical Transmission Electron Microscope [ATEM]) provide spatial resolution down to 1.4Å on suitably prepared samples. The high voltage EM's enable the researcher to examine thicker specimens. The ASTEM and ATEM are equipped with energy dispersive X-Ray (EDX) systems. The X-Ray analytical capability is used in conjunction with high resolution imaging for qualitative and quantitative elemental analysis of small amounts of material (down to cubic microns in bulk material and a few hundred nanometers in thin samples). The 002B ATEM is equipped with a low Z EDX system capable of light element detection down to beryllium. Two Scanning Electron Microscopes (a Hitachi S-530 and a JEOL 6400FE) are also available and are both equipped with energy dispersive X Ray (EDX) detectors. The 6400FE is a low voltage, high resolution field emission SEM capable of 15Å resolution and is equipped with a light element EDX system which can detect low Z elements down to boron. Finally, AIF is completely equipped for specimen preparation and technical photography in the physical sciences.

E. A. Wheeler, *Coordinator, WPS Microscopy Lab*

The Department of Wood and Paper Science Microscopy Lab has equipment necessary for the preparation and study of specimens with light microscopy.

M. J. Dykstra, *Director, CVM Laboratory for Advanced Electron and Light Optical Methods*

The CVM Laboratory for Advanced Electron and Light Optical Methods (CVM-LAELOM) is a full-service facility providing clinical and research support for the CVM as well as the full NCSU campus. The CVM-LAELOM houses a Philips 410LS transmission electron microscope and a JOEL JSM 35CF scanning electron microscope with all the necessary support equipment for tissue preparation as well as extensive darkroom facilities for the production of electron microscopy materials. The darkroom facility contains equipment for user-produced prints, 2 x 2 slides, 4 x 5 copy negatives, publication prints, posters, and film development. In addition, the CVM LAELOM offers the use of an epifluorescence Leitz Orthoplan compound light photomicroscope for bright field and fluorescence light microscopy, a Wild macroscope, and an Olympus CUE-3 color morphometric analysis system.

The CVM-LAELOM has a formal instructional program for all the systems in place and provides complete service support for all clients through its staff.

HIGHLANDS BIOLOGICAL STATION

R. C. Bruce, *Director*

As an institutional member of the Highlands Biological Foundation, Inc., NCSU helps support the Highlands Biological Station, an inland field station located 3,823 feet above sea level in the heart of North Carolina's southern Appalachians. The area has an extremely diverse biota and the highest rainfall in the eastern United States.

Facilities are available throughout the year for pre- and post-doctoral research in ecology, botany, zoology, soils and geology. Field-oriented research is supported by a laboratory building with research rooms and cubicles, a well equipped library, and five cottages and a

dining hall located on the edge of a six-acre lake. The station owns 16 acres surrounding the lake as well as several tracts of undisturbed forested land. Natural areas in the Nantahla, Pisgah, Sumter, and Chattahoochee National Forests are readily accessible from the station. Research grants available through the station provide stipends for room, board, and research expenses.

INSTITUTE OF STATISTICS

D. L. Solomon, *Director*

The Institute of Statistics is composed of two sections, one at Raleigh and the other at Chapel Hill. At NCSU, the institute provides extensive advisory services in experiment design, data management, data analysis, mathematical modeling and statistical computing to the University community and beyond. The institute has interaction with state and federal agencies and with private industries.

INTEGRATED MANUFACTURING SYSTEMS ENGINEERING INSTITUTE

C. F. Zorowski, *Director*

The Integrated Manufacturing Systems Engineering Institute was established at NCSU in 1984 to provide a multifaceted educational, research, and technology transfer initiative in manufacturing systems engineering. The objectives of this program are to educate engineers in the theory and practice of advanced design and manufacturing methods at the master's degree level; to conduct basic and applied research on topics related to contemporary manufacturing problems; and to engage in technology transfer to increase productivity and improve the quality of manufactured products.

The central goals of the institute are to integrate computer aided processes into the design and control of manufacturing facilities enabling them to produce manufactured goods of improved quality at lowered cost. Through both internally and externally funded research projects the institute helps solve generic manufacturing systems engineering problems and provides a vehicle for technology transfer.

MARS MISSION RESEARCH CENTER

F. R. DeJarnette, *Director*

The Mars Mission Research Center is one of nine University Space Engineering Research Centers established by NASA in 1988 to broaden the nation's engineering capability to meet the critical needs of the civilian space program. The goal of the center is to focus on educational and research technologies used in the design of spacecraft for robotic and human lunar Mars missions. It is a cooperative program involving faculty, undergraduate, and graduate students at NCSU and N.C. A&T State University. The research is a cross-disciplined program involving (1) hypersonic aerodynamics and propulsion, (2) composite materials and fabrication, (3) light-weight structures, and (4) spacecraft controls. Students and faculty conduct part of their research at NASA Centers and participating industries.

MICROELECTRONICS CENTER OF NORTH CAROLINA

A. Reisman, *Consultant to the President and Professor in the Department of Electrical and Computer Engineering*

NCSU is a participating member of the Microelectronics Center of North Carolina (MCNC) which has been established to support the academic and research programs in microelectronics. Other participating institutions are the University of North Carolina at Chapel Hill, Duke University, North Carolina Agricultural and Technical State University, the Research Triangle Institute and the University of North Carolina at Charlotte.

MCNC consists of a Semiconductor Research and Integrated Circuit Design and Fabrication Facility located at the Research Triangle Park near Raleigh. This facility is dedicated to the support of ULSI (Ultra Large-Scale Integration) microelectronics teaching and research programs at the participating institutions. Faculty and students at NCSU have access to the use of MCNC facilities on sponsored research projects and for formal academic courses including microelectronics design and fabrication laboratories. Areas of interest include system design, systems engineering, integrated circuit technology, semiconductor materials and device physics. Departments at NCSU which are actively involved in the program include Electrical and Computer Engineering, Computer Science, Physics, Chemistry, and Materials Engineering.

NORTH CAROLINA JAPAN CENTER

J. Sylvester, Jr., *Director*

The North Carolina Japan Center was established in 1980 at NCSU to strengthen academic, scientific, economic, and cultural ties between Japan and North Carolina. The center also helps conduct the formal exchange NCSU has with Nagoya University, a major national scientific university in Japan.

Under the North Carolina Japan Fellows program, 41 professors and staff have taken a year of Japanese language training and then worked in Japan for a half year with Japanese colleagues in their specialty. They use their Japanese experience in their teaching and research, and they participate in the activities of the center and of the state in its relations with Japan.

The center offers introductory and advanced levels of Japanese language for students and gives special seminars for businessmen and others interested in Japan. Public lectures are given on Japan by members of the staff and the Fellows. Various films dealing with modern Japan and North Carolina's ties with Japan have been prepared for teacher training, public television, and Japanese companies interested in investment in North Carolina. The center has raised an endowment in memory of former Provost Harry Kelly and his contribution to United States Japan scientific ties. The funds are used for scholarships for NCSU students to take special intensive programs in the Japanese language. The center also works with American companies selling to Japan and Japanese firms locating in North Carolina.

NUCLEAR SERVICES DIVISION

J. N. Weaver, *Manager*

Specialized nuclear service facilities are available to the University faculty, students, state and federal agencies, and industry. The purpose of these facilities is to further the use of nuclear energy in engineering research and in scientific and public service programs. The facilities include: a 1 megawatt steady-state, pool-type, research reactor (PULSTAR) with a variety of test facilities; a neutron activation analysis and radioisotope laboratory equipped with two ND6700 Gamma Spectrometry Systems coupled to ten GeLi solid state detectors, two LEPD detectors and two 5" NaI detectors; a prompt gamma facility; a neutron depth profile facility; a neutron radiography facility, a low level counting laboratory equipped with liquid scintillation systems, radon systems, alpha spectrometry systems and an oxidizer; intermediate hot laboratories with hoods, junior caves and glove boxes; transuranic nuclear materials laboratory and computing and photographic rooms.

The 50,000 square foot Burlington Engineering Laboratories complex houses the Department of Nuclear Engineering and the Department of Materials Science and Engineering with their associated offices and laboratories. All of the facilities including the reactor are on the NCSU campus.

PESTICIDE RESIDUE RESEARCH LABORATORY

R. B. Leidy, *Director*

The Pesticide Residue Research Laboratory is a facility in the College of Agriculture and Life Sciences devoted to research on pesticide residues in air, animals, plants, soils, water and other entities of man's environment. Although the laboratory is administered through the Department of Toxicology, it provides pesticide residue analyses for research projects in all departments of the college.

Not only does the laboratory perform interdepartmental residue research, but faculty in the laboratory also conduct independent pesticide research on persistence and decomposition of pesticides in air, soils and plants, absorption and translocation in plants, distribution in the environment, and contamination of streams, estuaries and ground water.

PLANT DISEASE AND INSECT CLINIC

R. K. Jones, *Director*

The Plant Disease and Insect Clinic (PDIC) provides a unique diagnostic and educational service to plant growers in North Carolina. It is an integral part of the extension program in the Plant Pathology and Entomology Departments. The PDIC receives approximately 8,000 problem samples each year. County Agents, Extension Specialists and growers submit samples from agricultural crops, forests, urban gardens, house plants, etc. This provides an opportunity to observe and work with practical problems currently developing and causing damage.

There are constant and increasingly rapid changes taking place in agricultural technology. These changes influence pest problems that require new types of assays and more sophisticated laboratory examinations. Plant problems must be correctly diagnosed and proper control strategies employed as quickly as possible for growers to minimize losses. The PDIC provides a vital link between the numerous highly specialized resources and faculty members at NCSU and the practical plant problems in the field. New or unusual outbreaks of plant diseases and insects can be quickly detected through the PDIC.

PRECISION ENGINEERING CENTER

Thomas A. Dow, *Director*

The Precision Engineering Center, established in 1982, is a multidisciplinary research and graduate education program dedicated to providing new technology for high precision manufacturing. Current work involves the fabrication and assembly of optical systems used in such products as cameras, copy machines, laser bar code scanners, and compact audio discs. Progress in precision is largely due to improvements in the ability to measure and control using high speed digital computers. The Precision Engineering Center attempts to integrate the measurement function into the manufacturing process. Skilled faculty, combined with government and industry support, help the center develop new products technology that boost productivity and improve the manufacturing base of the country.

REPRODUCTIVE PHYSIOLOGY RESEARCH LABORATORY

L. S. Bull, *Director*

The Reproductive Physiology Research Laboratory, administered through the Department of Animal Science, conducts research on animals used in studies on reproduction. Facilities and equipment are available for surgery, in vitro growth of embryos, micro-manipulation and transfer of embryos between females. Recent emphasis has been on teaching and research in the area of mammalian biotechnology.

SOUTHEASTERN PLANT ENVIRONMENT LABORATORY—PHYTOTRON

R. J. Downs, *Director*

The Southeastern Plant Laboratory, commonly called a phytotron, is a laboratory especially designed for research dealing with the response of biological organisms to their environment. The high degree of control makes it possible to duplicate any climate from tropical rain forests to arid desert.

The NCSU unit concentrates on applied and basic research related to agricultural problems encountered in the southeastern United States. However, the ability to control all phases of the environment allows inclusion of research dealing with all aspects of plant science.

The facilities are available to the resident research staff, participants in NCSU's graduate research program and to domestic and foreign visiting scientists.

TRIANGLE UNIVERSITIES NUCLEAR LABORATORY

N. R. Roberson, *Director*

TUNL is a laboratory for research in nuclear physics. Located on the campus of Duke University in Durham, the laboratory is staffed and operated by faculty members and students from the physics departments of Duke University, the University of North Carolina at Chapel Hill, and NCSU. A variety of pure and applied research is performed, at lower energies with a small accelerator, and up to 17 MeV with a Tandem Van de Graaff accelerator. Extensive supporting facilities are available: on-line computers, polarized targets, polarized and pulsed beams, and ultra-high beam energy resolution. There is extensive collaboration with the numerous domestic and foreign visiting scientists.

Institutional Advancement

J. P. McNeill, *Vice Chancellor for Institutional Advancement*

The Office of Institutional Advancement supports the University's evolution as a teaching, research, and extension and public service institution by fostering communications between the University and its constituencies through the offices of Alumni Relations, University Relations, and University Development. Administrative service functions for Institutional Advancement units are managed by the Office of Advancement Services.

ADVANCEMENT SERVICES

The Office of Advancement Services manages and supervises all Institutional Advancement administrative service functions so that the staff of Alumni Relations, University Development, and University Relations can focus on fundraising, programming, and public communication. These service functions include budget expenditures and procedures, financial analysis, computer data systems, gift processing, and donor relations activities.

ALUMNI RELATIONS

The Office of Alumni Relations provides services to the University's alumni, involves alumni in the University's advancement as an educational institution, and provides alumni with a forum to express their views on the University. The office maintains alumni records; communicates with alumni through various publications; organizes alumni activities such as reunions, tours, and area meetings; and informs alumni of educational opportunities and other services available to them from their alma mater. The NCSU Alumni Association is a non-profit organization administered by the staff of the Office of Alumni Relations.

Students and parents are invited to visit the Office of Alumni Relations, located in the Alumni Memorial Building on Pullen Road. To inquire about programs of service, call (919) 515 3375 or (800) NCS-ALUM; or write the NCSU Office of Alumni Relations, Box 7503, North Carolina State University, Raleigh, North Carolina 27695-7503.

UNIVERSITY DEVELOPMENT

The Office of University Development is the principal private fund-raising division of the University and seeks financial contributions from individuals, foundations, and corporations to support University programs. Development activities are administered through the following private support organizations:

The Board of Trustees of the Endowment Fund of North Carolina State University

N.C. Agricultural Foundation, Inc.

N.C. Dairy Foundation, Inc.

N.C. Engineering Foundation, Inc.

N.C. Forestry Foundation, Inc.

N.C. Physical and Mathematical Sciences Foundation, Inc.

N.C. Textile Foundation, Inc.

N.C. Tobacco Foundation, Inc.

N.C. Veterinary Medical Foundation, Inc.

N.C. 4-H Development Fund, Inc.

North Carolina State University Education Foundation, Inc.

North Carolina State University Foundation, Inc.

North Carolina State University Humanities Foundation, Inc.

North Carolina State University Parents' Association

North Carolina State University School of Design Foundation, Inc.

The Pulp and Paper Foundation, Inc.

UNIVERSITY RELATIONS

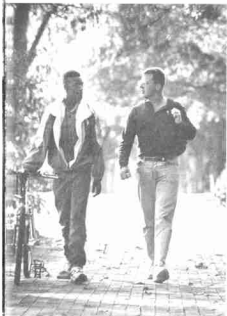
The Office of University Relations conveys the character and excellence of the University to its external and internal constituencies on behalf of the Chancellor, the Administration, and the Faculty; coordinates and supports the communications and marketing efforts of the Colleges, Schools, and Administrative Divisions; and ensures that the electronic and print media have access to complete and accurate information about the University. University Relations includes the Office of Information Services and the Office of Broadcast Services.

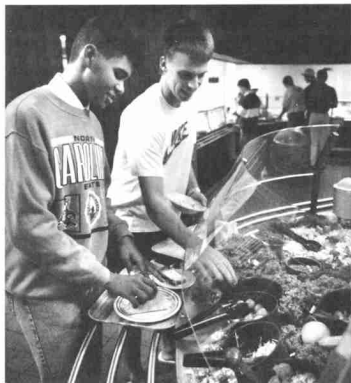


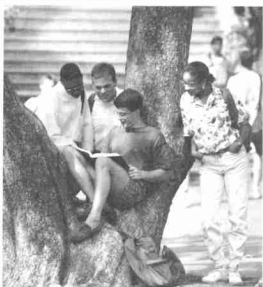
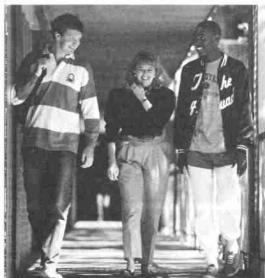
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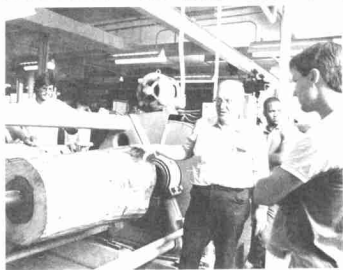
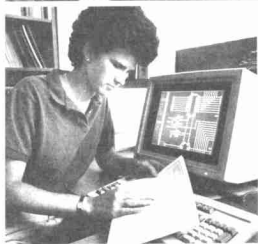


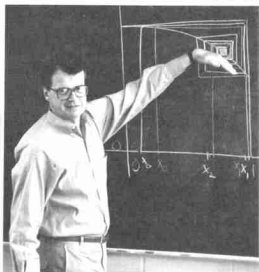


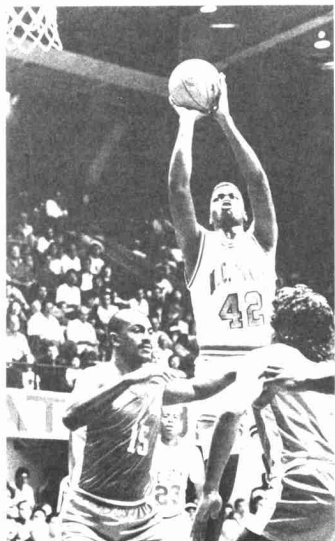


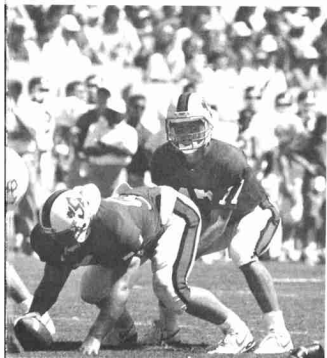














COURSE DESCRIPTIONS

The course descriptions are arranged first in alphabetical order according to **course prefix** reflecting the department or discipline of the course. Some courses are cross-listed, indicating that they are offered in two or more departments or disciplines. Within each of the prefix groups, the course descriptions are arranged by course number: numbers 100-299 are courses intended primarily for freshmen and sophomores; numbers 300-499 are courses intended primarily for juniors and seniors; numbers 490-498 are seminar, project, or special topics courses; number 499 is for undergraduate research.

This section contains all undergraduate courses, 100-level through 400 level, approved for the 1993 Spring Semester. It also contains selected 500-level graduate courses which are available to advanced undergraduates who have the required prerequisites. It does not contain any 600-level courses which are available to graduate students only. For a complete listing of 500- and 600-level courses, see the *Graduate Catalog*.

A typical course description shows the prefix, number, and title followed by prerequisite, credit, and offering information. **Prerequisites** are courses or levels of achievement that a student is expected to have completed successfully prior to enrolling in a course. **Corequisites** are courses which should be taken concurrently by students who have not previously completed the corequisites. Prerequisites and corequisites for a given course may be waived by the instructor of the course or section. It is the student's responsibility to satisfy prerequisites, or obtain from the instructor written waiver of prerequisites, for any course in which he or she may enroll. Failure to satisfy prerequisites may result in removal from enrollment in the course. Consent of the department is required for all practicum and individual special topics or special problems courses as well as internships and thesis or dissertation research. Some courses also have **restrictive statements**, such as "Credit in both MA 141 and MA 131 is not allowed." Restrictive statements for a given course may be waived only by a college dean.

An example of **credit** information is: 4(3-2) F, S, Sum. The 4 indicates the number of semester hours credit awarded for satisfactory completion of the course. The (3 2) normally indicates that the course meets for three hours of lecture or seminar each week and for two hours of laboratory, problem, or studio work each week. Some courses are offered for variable credit, and a listing of 1 6 indicates that from one to six semester hours of credit may be earned as arranged by the department offering the course.

Offering information is shown as F, S, Sum, Alt. yrs. F indicates that the course is normally offered in the Fall Semester, S indicates the Spring Semester, and Sum. indicates the Summer Sessions. Alt. yrs. indicates the course is normally offered in alternate years. The absence of offering information indicates that there is no fixed pattern, and students should check with the department concerning when a particular course will be offered.

Other abbreviations used in the course descriptions are: CI, consent of instructor required; grad., graduate; undergrad., undergraduate; sr., senior; jr., junior; soph., sophomore; fr., freshman; lab., laboratory; lect., lecture; and sem., seminar.

CONTENTS

AC	Agricultural Communications	BCH	Biochemistry
ACC	Accounting	BMA	Biomathematics
ALS	Agriculture and Life Sciences	BO	Botany
ANS	Animal Science	BS	Biological Sciences
ANT	Anthropology	BUS	Business Management
ARC	Architecture	CE	Civil Engineering
ARE	Agricultural and Resource Economics	CFR	Forest Resources
ART STUDIES		CH	Chemistry
AS	Aerospace Studies	CHE	Chemical Engineering
BAE	Biological and Agricultural Engineering	CL	Comparative Literature
		COM	Communication
		CS	Crop Science
		CSC	Computer Science

DAN	Dance	HSS	Humanities and Social Sciences
DF	Design Fundamentals	ID	Industrial Design
DN	Design	IE	Industrial Engineering
E	Engineering	LAR	Landscape Architecture
EAC	Adult and Community College Education	LAT	Latin Language and Literature
EC	Economics	MA	Mathematics
ECG	Economics (Graduate)	MAE	Mechanical and Aerospace Engineering
EC	Economics	MAT	Materials Science and Engineering
ECD	Counselor Education	MB	Microbiology
ECE	Electrical and Computer Engineering	MDS	Multidisciplinary Studies
ECI	Curriculum and Instruction	MEA	Marine, Earth, and Atmospheric Sciences
ED	Education	MS	Military Science
ELP	Educational Leadership and Program Evaluation	MUS	Music
EMS	Mathematics Science Education	NE	Nuclear Engineering
ENG	English	NS	Naval Science
ENT	Entomology	NTR	Nutrition
EOE	Occupational Education	OR	Operations Research
FL	Foreign Languages and Literatures	PA	Public Administration
FLC	Chinese Language and Literature	PE	Physical Education
FLE	English for International Students	PEH	Physical Education—Health Studies
FLF	French Language and Literature	PHI	Philosophy
FLG	German Language and Literature	PHY	Physiology
FLH	Hebrew Language and Literature	PMS	Physical and Mathematical Sciences
FLI	Italian Language and Literature	PO	Poultry Science
FLJ	Japanese Language and Literature	PP	Plant Pathology
FLK	Swahili (Kiswahili) Language and Literature	PRT	Parks, Recreation, and Tourism Management
FLP	Portuguese Language and Literature	PS	Political Science
FLR	Russian Language and Literature	PSY	Psychology
FLS	Spanish Language and Literature	PY	Physics
FOR	Forestry	REL	Religion
FS	Food Science	SOC	Sociology
FW	Fisheries and Wildlife Sciences	SSC	Soil Science
GC	Graphic Communications	ST	Statistics
GD	Graphic Design	SW	Social Work
GEO	Geography	T	Textiles
GN	Genetics	TAM	Textile and Apparel Management
GRK	Greek Language and Literature	TC	Textile Chemistry
HA	History of Art	TE	Textile Engineering
HI	History	TED	Technology Education
HS	Horticultural Science	TES	Textile Engineering and Science (see TMS—Graduate)
		TMS	Textile Materials Science
		TOX	Toxicology
		TS	Textile Science
		TT	Textile Technology
		VMF	Veterinary Medicine
		WPS	Wood and Paper Science
		ZO	Zoology

AGRICULTURAL COMMUNICATIONS

AC 311 Communication Methods and Media. *Prereq: ENG 112, 3(3-0) F.* Foundational frameworks of agricultural communications. The technologies of communication and the systematic approach to the development of communication materials. Development of applied skills in the areas of design, production, evaluation, and dissemination of information unique to the agriculturist.
BOSTICK

AC 470 Agricultural Communications. *Prereq: AC 311. Senior Standing, 3(3 0) S.* The org., research and structure of informational techniques and delivery systems designed for Agricultural Communications producers and consumers. A study of the traditional to current needs and ramifications.
BOSTICK

AC (FW) 485 Natural Resources Advocacy. *Prereq: ENG 321, 3(2-3) S.* Analysis of natural resources problems as they affect management agencies and user groups. Development of professional attitudes, policies, and skills needed for the management of sensitive natural resource issues through application of techniques in the field. Student presentations, demonstrations and development of natural resource planning models that integrate biological skills with management alternatives and are critiqued by resource field staff.

Selected 500-level Courses Open to Advanced Undergraduates

AC 590 Special Topics in Agricultural Communications. *Prereq: Sr. or grad. standing, 1 6.*

ACCOUNTING

ACC 100 Introduction to Accounting Profession *1(1 0) F.* Introduction to accounting profession and career opportunities.

ACC 200 Computerized Accounting Applications *1(0-2) F,S.* Computers in accounting; operating systems, word processing, spreadsheets, and general ledger accounting systems. The accounting cycle with a computerized accounting practice set. Uses microcomputers.

ACC 210 Accounting I Concepts of Financial Reporting. *Credit may not be received for both ACC 210 and 280 or 260, 3(3-0) F,S,Sum.* Financial reporting concepts, the information generating process, income measurement, resource valuation, corporate equity measurement, reporting practices, and the interpretation and analysis of financial statements. Basic accounting principles and concepts, the accounting cycle, purchase and sale transactions, internal controls dealing with cash, receivables and payables, inventories, and plant and equipment considerations.

ACC 220 Accounting II—An Introduction to Managerial Accounting. *Prereq: ACC 210. Credit may not be received for both ACC 220 and 280 and 261, 3(3-0) F,S,Sum.* Analysis of accounting data that are useful in managerial decision making and in the control and evaluation of the decisions made within business organizations. An introduction to basic models, financial statement analysis, cost behavior analysis and cost control procedures.

ACC 280 Managerial Accounting. *Credit may not be received for both ACC 280 and ACC 210, or 220, 3(3-0) F,S.* Principles underlying financial reporting. Analysis of cost and other quantitative data for managerial decision making. Focus on uses of accounting information.
FERRARO, JOHNSON

ACC 300 The Accounting Profession. *1(2 0) S Prereq: Students must enroll during the 2nd semester of junior year.* Integration of work values, career interests, and skills with organizations and career paths related to accounting. Ethics, certification, continuing education, and research. Minimal fee assessed to cover cost of career test administered during course.
BROOKS

ACC 310 Intermediate Financial Accounting I. *Prereq: ACC 210 with grade of C or better; ACC 200; Coreq: ACC 220. Credit may not be received for both ACC 310 and 360 3(3 0) F,S,Sum.* Conceptual framework of financial accounting and application of professional

standards. Measurement and reporting issues related to cash, accounts receivable inventories, operating assets, and intangible's.

BARTLEY, BRANSON, COMSTOCK, GRIFFIN, MARSH

ACC 311 Intermediate Financial Accounting II. *Prq: ACC 310 with a grade of C or better. Credit may not be received for both ACC 311 and 361. 3(3 0) F.S.* Sum. Theory and professional standards for analyzing and reporting enterprise liabilities and equities. Valuation of liabilities, contingencies, stock transactions, and dividends. Measurement and reporting issues related to dilutive securities, leases, and pensions.

FRAZIER, GRIFFIN, ROCKNESS

ACC 312 Intermediate Financial Accounting III. *Prq: ACC 311 with a grade of C or better. Credit may not be received for both ACC 412, ACC 410 or 401. 3(3 0) F.S.* Sum. Complex income measurement and disclosure issues. Valuation and reporting problems pertaining to intercorporate investments, specialized revenue recognition, income tax allocation, accounting changes and cash flow analysis. Fund accounting for governmental units and nonprofit organizations.

BARTLEY, COX, FRAZIER

ACC 320 Managerial Uses of Cost Data. *Prq: ACC 220 with grade C or better. Credit may not be received for both ACC 320 and 262. 3(3 0) F.S.* Sum. Managerial uses of cost data in planning, controlling, and evaluating organizational activities and in making business decisions. Budgeting, cost behavior, product costing and pricing, and an introduction to production cost.

CHEN, RODGERS, WILLIAMS, ZUCKERMAN

ACC 330 An Introduction To Income Taxation. *Prqs: ACC 210 and EC 201. Credit may not be received for both ACC 330 and 364. 3(3-0) F.S.* Principles and procedures of individual and business entity income taxation. Basic definitional tax concepts of income deduction, credit, and gain or loss. Tax research methodology and tax planning techniques.

CARRAWAY, KRAWCZYK, McCLENNY, MESSERE, PEACE, SAWYERS

ACC 408 Commercial Law for Accountants. *Prq: BUS 307 3(3 0) S.* The principles of the Uniform Commercial Code applicable to the practice of public accounting. Emphasis on sales, commercial paper, bankruptcy, corporations, and accountant's legal liability.

ACC 420 Production Cost Analysis and Control. *Prq: ACC 320 and EB 350. Credit may not be received for both ACC 420 and 362. 3(3 0) F.S.* Managerial reporting practices for producing activities, development and use of cost standards and budgets, and cost measurement of productive inputs for units of productive outputs. Managerial use of cost data in analyzing, planning, and controlling business activity. Consideration of information systems and internal controls.

ZUCKERMAN

ACC 430 Advanced Income Tax. *Prqs: ACC 310, 330. Credit may not be received for both ACC 430 and 465. 3(3 0).* Federal income tax treatment of corporations; partnerships; estates; trusts; and profit and loss distributions to shareholders, partners, and beneficiaries. Introduction to wealth transfer taxes and family planning.

MESSERE, PEACE

ACC 440 Accounting Information Systems. *Prqs: ACC 200, ACC 310, ACC 320, CSC 200. Credit cannot be received for both ACC 440 and 440. 3(2 2).* Systems concepts, including the theory, principles, and controls inherent in accounting systems analysis, design, and development. Subsystems of the total accounting system including sales receivable, purchases payable, cash receipts, cash disbursements, payroll, inventory, and production subsystems. Uses microcomputers.

GRIFFIN

ACC 450 Auditing Financial Information. *Prq: ACC 311. BUS (ST) 350. Credit may not be received for both ACC 450 and 466. 3(3 0)S.* Objectives, procedures, practices and theory of the examination of financial information; the professional standards and ethical codes of the public accounting profession; features of internal control and EDP systems and other professional topics including overview of internal and operational auditing and SEC requirements; extensive use of professional literature and authoritative pronouncements.

BUCKLESS, SKENDER

ACC 451 Advanced Auditing Topics. *Prq: ACC 450. 3(3 0).* Advanced coverage of financial auditing topics.

ACC 460 Advanced Financial Reporting. *Preq: ACC 311. 3(3 0).* Accounting for corporate mergers and acquisitions, consolidated financial statements, partnerships, business reorganizations and liquidations. Multinational accounting, segment and interim reporting, and SEC disclosure requirements.
ROCKNESS, SKENDER

ACC 470 Accounting Theory. *Preq: ACC 312 (410). Credit may not be received for both ACC 470 and 489. 3(3 0).* Major concepts, problem areas and trends in accounting thought and practice, including a review of the most prominent controversies in current publications and the most recent relevant pronouncements of professional institutions.
FRAZIER, WILLIAMS

ACC 480 Accelerated Survey of Financial and Management Accounting. *Credit may not be received for both ACC 480 and ACC 220, 280 or 469. Intended for graduate students and advanced undergraduates not in Economics and Business. 3(3-0) F.* Accelerated survey of basic concepts underlying accounting in profit oriented firms: data measurement, summarization and reporting practices as a background for use of accounting information; content of published financial statements; and uses of accounting for management decisions in product costing, budgeting, and operations.
FRAZIER, ROCKNESS

ACC 490 Senior Seminar in Accounting. *Enrollment in this course is restricted to accounting majors in their final semester of study. PBS students admitted by permission of department head. 3(3 0) S.* Integration of financial, managerial, tax, and governmental accounting. Application of appropriate accounting methods to problem resolution.
SKENDER

ACC 495 Special Topics in Accounting. *Preq: Consent of Instructor. 1 6.* Presentation of material not normally available in regular course offerings, or offering of new courses on a trial basis.

ACC 498 Independent Study in Accounting. *1-6. F,S,Sum.* Detailed investigation of topics of particular interest to advanced undergraduates under faculty direction on a tutorial basis. Credits and content determined by faculty member in consultation with the Department Head.

Selected 500-Level Course Open to Advanced Undergraduates

ACC 520 Advanced Management Accounting. *Preqs: ACC 480, BUS(ST) 350 and EC 501. 3(3 0) S.*

AGRICULTURE AND LIFE SCIENCES

ALS 103 Introductory Topics in the Agricultural and Life Sciences. *1(1 0) F,S. Not open to seniors.* Introduction to scope and objectives of University education. Emphasis on sciences, particularly as related to biology and agriculture. Guest lectures, departmental programs and career opportunities.
ESBENSHADE

ALS 110 Agriculture and Life Sciences Scholars Forum. *Preq: Enrollment limited to participants in the Agriculture and Life Sciences Scholars Program. 0(2 0) F.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.
GRANT

ALS 299 Agriculture and Life Sciences Honors Seminar. *Enrollment by invitation for sophomores or juniors in CALS with GPA 3.25 or higher. 2(2-0) S.* A seminar discussion honors course with emphasis on the scientific method; exposure to library, laboratory and field research strategies and teaching techniques; acquaintance with training and career opportunities in the agricultural and life sciences; participation in two-day, off-campus CALS Honors Retreat.
GRANT

ALS (HSS) 490 International Seminar. *Preq: Junior standing. 1(1-0) S.* Cultural, economic and social aspects of developing countries, focusing on factors involved in change and the process of development. GROVE

ALS 495 Special Topics in Agriculture and Life Sciences. *1-3 F.S. Sum.* Offered as needed to present material not normally available in regular departmental course offerings or for offering of new courses on a trial basis. OBLINGER

ALS 498 Honors Research or Teaching I. *Preqs: ALS 299 & GPA 3.25 or higher. A maximum of 6 credits for ALS 498 & ALS 499 combined. 1-3 F.S. Sum.* Honors research or teaching for students in Agriculture and Life Sciences. First of a two-course sequence. Identification of a project and development of a proposal; literature search, planning, and work initiation. GRANT

ALS 499 Honors Research or Teaching II. *Preq: ALS 498 & GPA 3.25 or higher. A maximum of 6 credits for ALS 498 and ALS 499 combined. 2-4 F.S. Sum.* Honors research or teaching for students in Agriculture and Life Sciences. Completion of work initiated in ALS 498. Analysis of results. Preparation and presentation of written and oral reports. GRANT

ANIMAL SCIENCE

ANS 100 Perspectives in Animal Science. *1(1-0) F.* Discussion of current status of animal agriculture, extension and research. Career opportunities and qualifications for employment in animal agriculture and related fields. CORNWELL

ANS 130 Anatomy and Physiology of Domestic Animals. *Preq: BS 100. Coreq: BS 100. 4(3-2) S.* Concepts relating mammalian structure and function with emphasis on livestock species. Fundamentals of neuromuscular activity, digestion, absorption and metabolism as well as regulation of homeostasis relevant to production of milk, wool, and muscle growth efficiency. ALSTON MILLS

ANS 200 Introduction to Animal Science. *3(2-2) F.S.* The fundamental principles of animal production. The importance of livestock and livestock products in the human diet and in the economy. RAKES

ANS 201 Techniques of Animal Care. *Preq: ANS 200 or 230. 2(0-4) S.* A laboratory course in the applied management of beef cattle, dairy cattle, swine and sheep with participatory assignments of common techniques utilized in animal production. DAVENPORT, RAKES

ANS 202 Techniques of Horse Care. *Preq: ANS 200 or 230. 2(0-4) F.* A laboratory course providing students opportunities to learn applied management skills required in horse production. Participatory assignments of common techniques utilized in horse production will be emphasized. BARNETT

ANS 210 Microcomputers in Animal Production. *2(1-2) F.S.* Use of microcomputers to better understand animal production and management concepts. Word processing, spreadsheets, data base management and specialized accounting and planning programs. CARUOLO, WILK

ANS 220 Reproduction, Lactation and Behavior of Domestic Animals. *Preq: ANS 130. 4(3-3) F.* Biological processes in reproduction, lactation and behavior with emphasis on domestic animals. Environmental and genetic factors that affect these processes. Identification, evaluation and solutions for problems in these physiological areas. ARMSTRONG

ANS 230 Genetics, Nutrition and Growth of Domestic Animals. *Preq: ANS 220. 4(3-2) S.* Principles of genetics, nutrition and growth in domestic animals. Relationship of such principles to efficient animal production. EISEMANN

ANS 250 Applied Animal Nutrition. *Preq: ANS 230 or ANS 200. 3(2-2) S.* Applied nutrition of livestock and poultry. Classification, harvesting, processing and use of feed-stuffs. Formulation of rations to meet nutritional requirements.

ANS 300 Animal Production Field Study Trip. *1(0 2) F,S.* Animal agriculture and related agribusiness in North Carolina. Three-day field trip with fee required.

DAVENPORT

ANS (FS, NTR) 301 Introduction to Human Nutrition. *Preq: Sophomore standing. Food science majors may use as a free elective only. 3(3-0) F,S.* Functions, dietary sources and deficiencies of essential nutrients in humans; a balanced diet; role of nutrients in heart disease, cancer, hypertension, osteoporosis; weight control and eating disorders; vegetarianism; food safety; dietary supplements; government regulation of food supply; food quackery.

ASH

ANS 303 Principles of Equine Evaluation. *2(1-3) S.* Conformation as it relates to the function, performance and soundness of the horse. Breed standards, rules and regulations pertaining to evaluation, selection and performance. One or two overnight field trips are required.

BARNETT

ANS 308 Advanced Livestock Judging. *May be repeated three times with one credit for each category of livestock covered.* Intensive practice in judging market and purebred meat animals, dairy cattle, or horses. Extensive field trips. Some student expense.

ANS 310 Basic Horse Husbandry. *Cannot substitute for ANS 410 in fulfilling departmental requirements. 3(2 2) F.* Basic principles of horse husbandry; origin, breeds and functions of horses; basics of feeding, breeding, behavior, disease prevention and management. Field trips.

CORNWELL

ANS (FS, PO) 322 Muscle Foods and Eggs. *Preq: BS 100. 3(2 3) F.* Processing and preserving fresh poultry, red meats, seafoods, and eggs. Ante and post-mortem events as they affect quality, yield and compositional characteristics of muscle tissues.

BALL

ANS (FS) 324 Milk and Dairy Products. *Preq: BS 100. 2(2-0) F.* Composition of milk and dairy products, federal standards, raw milk procurement, cleaning and sanitizing and quality attributes.

HANSEN

ANS 340 Selection of Domestic Animals. *Preq: ANS 230, ANS 210. 3(2 3) F.* Modern evaluation and selection procedures for domestic animals; selection goals, estimation of breeding values and performance testing; their impact on genetic changes.

ROBINSON

ANS 402 Beef Cattle Management. *Preq: ANS 230 or ANS 200. 3(2-3) S.* Principles and practices of production, management and marketing of beef cattle. Modern management practices, emphasizing the application of principles of genetics, nutrition, reproduction and animal health.

HARVEY

ANS 403 Swine Management. *Preq: ANS 230 or ANS 200. 3(2 3) F.* The economic, nutritional, genetic, physiological and managerial factors affecting the operation of modern swine enterprises. Practices for the commercial producer emphasized. Laboratory trips required.

FLOWERS

ANS 404 Dairy Cattle Management. *Preq: ANS 230 or ANS 200. 3(2-3) S.* The management of economic, nutritional, genetic, and physiological factors that influence the operation of a dairy enterprise.

RAKES

ANS 406 Sheep Management. *Preq: ANS 230 or ANS 200. S, Alt. yrs.* The economic, genetic, nutritional, physiological and managerial factors affecting the operation of the modern sheep enterprise.

POND

ANS 410 Equine Management. *Preq: ANS 230 or ANS 200. 3(2 2) S.* Equine anatomy, physiology, nutrition, genetics and health. Laboratory emphasis on reproductive management, breeding, problem solving, and management skills. Field trips required.

CORNWELL

ANS 412 Applied Animal Breeding. *Students may elect to take 1, 2, 3, or 4 of ANS 412 A, B, C, or D. 1 4 S.* Breeding methods for improvement of specific classes of livestock presented as a series of mini courses. ANS 412A, Applied Beef Cattle Breeding; ANS 412B, Applied Dairy Cattle Breeding; ANS 412C, Applied Swine Breeding; ANS 412D, Genetics and Breeding Selected Topics.

ANS (NTR, PO) 415 Comparative Nutrition. *Preqs: CH 220 or both 221 and 223. 3(3-0) F.* Principles of nutrition, including the classification of nutrients and the nutrient requirements of and species for health, growth, maintenance and productive functions.

DONALDSON

ANS (NTR) 419 Human Nutrition in Health and Disease. *Preqs: BCH 451, NTR 415 or FS 400. 3(3 0) S.* (See NTR Nutrition.) ASH

ANS 490 Seminar in Animal Science. *2(2 0) F.* Reading, evaluating, summarizing and presenting scientific information pertinent to animal science and production in animal genetics, nutrition and physiology. Personal resume and job inquiry letter writing and employment interviewing.

ANS 492 External Learning Experience. *Preq: Sophomore standing. 1-6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

ANS 493 Special Problems in Animal Science. *Preq: Sophomore standing. 1-6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes departmental campus facilities and resources (Arrangements must be initiated by student and approved by a faculty adviser and the departmental teaching coordinator).

ANS 495 Special Topics in Animal Science. *1 3 F, S, Sum.* Offered as needed to present material not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

ANS 500 Advanced Ruminant Nutrition. *Preq: ANS 250 or ANS 415. 3(3 0) Alt. Sum.*

ANS (PHY) 502 Reproductive Physiology of Vertebrates. *Preq: ZO 421. 3(3 0) S.*

ANS (GN) 508 Genetics of Animal Improvement. *Preqs: GN 411, ST 511. 3(3 0) S.*

ANS 510 Advanced Livestock Management. *Preq: ANS 402 or ANS 403 or ANS 404 or 410. 3(3 0) S.*

ANS (NTR) 516 Quantitative Nutrition. *Preq: BCH 451 or NTR (ANS) 415 or NTR (ANS) 419 or FS 400. 3(1 6) S.*

ANS 520 Tropical Livestock Production. *Preq: Six hours of ANS at 400-level. 3(3-0) F.*

ANS (NTR) 540 Ruminant Physiology and Metabolism. *Preqs: BCH 451 or 551, ZO 421. 3(3 0) F. Alt. yrs.*

ANS (PHY) 580 Mammalian Endocrine Physiology. *Preqs: BCH 451, ZO 421. 3(3 0).*

ANS 590 Topical Problems in Animal Science. *Maximum 6 F.S.*

ANTHROPOLOGY

(Also see SOC Sociology; SW Social Work.)

ANT 251 Physical Anthropology. *3(3 0) F,S,Sum.* Introduction to the study of human evolution. Topics include the processes of evolution, human variation and race, behavior and morphology of nonhuman primates, and the fossil record. Emphasis is placed on the study of human biosocial adaptation, past and present, and on humans as culture bearing primates.

ANT 252 Cultural Anthropology. *3(3 0) F,S,Sum.* Comparative study of contemporary human culture, social institutions and processes that influence behavior. The range of human cultural variation shown throughout the world, including the student's own culture system.

ANT 253 Introduction to Prehistory. *3(3 0) F,S,Sum.* World wide survey of origins of human society, technology and culture in Old Stone Age, and origins of agriculture, cities, and civilizations of the Bronze and Iron Age in Europe, Asia, Africa, and pre Columbian Middle and South America.

ANT 254 Language and Culture. *3(3 0) F,S.* Focuses on the relationship among aspects of human language and between aspects of language and culture. Surveys such topics as: descriptive and comparative linguistics, structuralism, language and thought, sociolinguistics, bilingualism, culture change and linguistic change.

ANT (SOC) 261 Technology in Society and Culture. *3(3 0) F,S.* Processes of social and cultural change with focus on role of technological innovation. Cross-cultural emphasis. Special attention to role of scientists and engineers in socio cultural change. Social and cultural impact analysis of planned technological change. Topical case studies apply course concepts and principles. Includes core sociological concepts, methods, theories.

ANT 310 Indians of North America. *Preq: ANT 252 or ANT 311 or HI 365. 3(3-0).* Indian peoples and cultures north of the Rio Grande. Theories of origin; selected prehistoric cultural manifestations; people and cultures at the time of European contact; concomitants and ramifications of post contact cultural change; and contemporary Indian problems and prospects. Eskimos and Aleuts included.

ANT 311 Archaeology of North America. *Preqs: Three hours introductory anthropology or sophomore standing. 3(3-0).* Reviews archaeological investigations in North America, beginning with the first Stone Age immigrants to cross the Bering Land Bridge and their expansion over the rest of the North American continent. The diversity of early Eskimo and Indian cultures, social and technological developments, and environmental adaptations during the 10,000 years prior to European arrival will be studied.

ANT 325 Andean South America. *Preqs: 3 hours ANT, or HI 215 or HI 216. 3(3-0).* The societies, cultures, politics, economics and ecology of the Andean countries of South America (Peru, Bolivia, Ecuador, Chile, Colombia). Special attention to agrarian systems.

ANT 330 Peoples and Cultures of Africa. *Preqs: Three hours cultural anthropology or HI 275 or HI 276. 3(3-0).* S. African peoples and cultures, especially in sub Saharan Africa; past and present social patterns of indigenous African populations from a cross cultural perspective.

ANT 373 The Human Fossil Record. *Preq: Three hours physical anthropology or archaeology. 3(3-0).* Analysis of the human fossil record and consideration of alternate theories of human evolution.

ANT (COM, HSS, SP) 392 International and Cross-cultural Communications. *3(3 0)* S. Patterns and problems of verbal and non-verbal forms of cross cultural communication. Avoidance and management of cultural conflict arising from awareness of characteristics of cross cultural communication. Impact on communication of differing cultural perspectives.

ANT 416 Research Methods in Cultural Anthropology. *Preq: Six hours ANT, 3(3 0).* A systematic overview of cultural anthropological research methods including designing research projects, research techniques, field work methods, and cross cultural comparison. Reviews relevant ethical questions and anthropologists' reports of their own field work.

ANT 420 Biological Bases for Human Social Behavior. *Preq: ANT 251 or 3 hours biological sciences, 3(3-0).* Relevance and applicability of animal behavior to the study of human social behavior. Nature and uniqueness of human behavior in light of social behavior of animals, particularly the nonhuman primates.

ANT 460 Urban Anthropology. *Preq: ANT 252, 3(3 0).* Anthropological study of cities. Examination of cross-cultural patterns of behavior in urban areas and adaptive strategies that urban dwellers employ. Introduction to major theoretical and methodological approaches relevant to an understanding of contemporary urbanization.

ANT 498 Special Topics in Anthropology. *Preq: Six hours of SOC ANT 1 6 F.S.S.Sum.* Detailed investigation of a special topic in anthropology. Topic and mode of study determined by faculty members and students. Also offered as needed for new courses.

Selected 500-Level Courses Open To Advanced Undergraduates

ANT 508 Culture and Personality. *Preq: 6 hours in cultural anthropology, 3(3-0).*

ANT 511 Anthropological Theory. *Preqs: 6 hours in cultural anthropology, 3(3-0).*

ANT 512 Applied Anthropology. *Preq: ANT 252 or CI, 3(3-0).*

ARCHITECTURE

(Also see DN Design.)

ARC 140 Experiencing Architecture. *3(3 0) F.* Contemporary and historic houses, public buildings and cities illustrate the practical and aesthetic aspects of architecture. The basic elements of architectural form, design process, and architectural criticism.

HARMON

ARC 141 History of Design I. *3(3 0) F.* Western design from prehistory to Imperial Rome through examples of architecture and construction, landscape and urban planning, pure and applied three- and two dimensional artifacts in their cultural setting. Students draw and or construct selected historical design solutions.

REUER

ARC 142 History of Design II. *3(3-0) S.* Western design from the early Christian to the Modern Age through examples of architecture and construction, landscape and urban planning, pure and applied three and two-dimensional artifacts in their cultural setting. Students draw and or construct selected historical design solutions.

REUER

ARC 202 Architectural Design: Environment. *Preqs: DF 102, ARC 211, ARC 252, Architecture majors, 6(0 9) S.* Architectural design studio emphasizing the relationship of user, environment, context, and climate to building design.

ARC 211 Natural Systems and Architecture. *Preq: DF 102, 3(3 0)F. Restricted to students in BEDA Program.* Relationship between natural and architectural systems. Strategies for advantageous use and manipulation of environmental forces and energies. Energy conscious architectural design and site planning strategies to fulfill thermal comfort requirements of people in designed environments.

BIZIOS, RIFKI

ARC 232 Structures and Materials. *3(2 2)S.* Construction materials related to structural applications. Theory of structures and introduction to quantitative analysis. Implications for design. Historical examples and current practices. Laboratory and field trips required.

HARMON, RAND

ARC 244 History of American Architecture. *Does not fulfill humanities elective for School of Design students, 3(3 0)S.* Survey of American architecture from Colonial times to the Second World War.

- ARC 252 Computer Methods in Architecture.** *Preqs: 6 hours in ARC 400 or ARC 202. 3(2-2) F.S.* An introduction to computers and design methods through applications of architectural graphics, word processing, and spreadsheet software to architectural design decision-making. TECTOR
- ARC 261 Design Methods.** *3(3 0) F.* Description, comparison, and testing of methods available in design with emphasis on problem-solving techniques. TECTOR
- ARC 263 The Profession of Architecture.** *1(1-0) F.* Introduction to architecture as a profession. Historical evolution of the profession, concepts of professionalism and ethics, legal and institutional foundations, and case studies of professional roles in architecture. BURNS
- ARC 292 Special Topics in Architecture.** *Preq: Consent of Instructor. 1 3 F.S./Sum.* Topics of current interest in Architecture. Normally used to develop new courses.
- ARC 302 Architectural Design: Technology.** *Preqs: ARC 202, ARC 232, Architecture majors. 6(0 9) S.* Architectural design studio emphasizing the nature and use of architectural structures, materials, and construction systems in building design.
- ARC 331 Architectural Structures I.** *Preq: ARC 232 3(2 2) F.* Structural design process. Combined role of imposed loads and architectural function in shaping the form of the building. Interaction of elements in structural systems containing beams, columns, trusses, space frames, slabs, arches, vaults, domes, cables, cable networks, fabrics and diaphragms. Case studies emphasized. PLACE
- ARC 332 Architectural Structures II.** *Preq: ARC 331 3(2 2) S.* Structural systems explored through case studies and design projects. Emphasis on interaction of structural elements. Tracing of loads in structural systems. Sizing of tensile elements, columns, trusses, and flexural elements. Design and sizing of joints. PLACE
- ARC 369 Practicum in Architecture.** *Preqs: One Arch. Studio ARC majors only. Sum. Credit may be use only in BEDA, B.ARCH, M.ARCH. 2 F.S.* 400 hours of work experience in an architectural office or equivalent work experience in a related discipline. Student chooses work setting and must make own arrangements. Work activities must be outlined in advance with the employer and with the advice and consent of the Head of the Architecture Department. Student must document work experience. SACCOPOULOS
- ARC 400 Architectural Design.** *Preq: DF 102. 6(0-9) F.* Studies in architectural design. Projects of many types and scales employed to investigate issues in architecture. Emphasis on independent exploration of design values and their implications.
- ARC 402 Architectural Design: History.** *Preq: ARC 302, ARC 400, ARC 441. 6(0 9) S.* Architectural Design Studio emphasizing the role of precedent in Architecture. Projects utilize comparative studies of concepts and buildings as a basis for design.
- ARC 403 Pregraduate Architectural Design (Series).** *Track 3 M. ARC students only. Maximum of 24 credit hours. 6(0 12) F.S.* Studies in architectural design to prepare students with no formal background for entry into the ARC 600 studio sequence. Studio projects deal with typical issues of building design in a range of scales, with an emphasis on processes and skills.
- ARC 414 Environmental Control Systems.** *Preq: ARC 211, Junior standing. 3(3 0) S.* Studies in light, heat, moisture, air motion, and sound in architectural environments. Mechanical, electrical and/or electronic equipment for illumination, heating, cooling, ventilation, vertical transportation and communication in buildings. Water and waste, fire protection and safety, and acoustic systems in architecture. RIFKI
- ARC 432 Architectural Construction Systems.** *Preq: ARC 232. 3(2 3) F.* Building construction systems related to architectural design. Historical and current building practices. Implications for design and systems selection. Case studies. Field trips are required. RAND

ARC 441 History of Contemporary Architecture. *Preq: Junior standing or ARC 141 or 142. 3(3 0) F.* A survey and critical examination of modern architecture from its origins in 19th century philosophy and technology to the most recent developments in world architecture. CLARK

ARC 451 Illumination and Design. *Preq: ARC 253. 3(2 2) S.* Principles and design methods for the illumination of buildings and their interior spaces. Students employ model simulation to explore and evaluate alternative lighting designs for various architectural situations. RIFKI

ARC 452 Environmental Control Systems and Design. *Preq: ARC 253. 3(2 2) S.* Natural and mechanical systems for heating, cooling and ventilating buildings with emphasis on energy conscious design approaches. RIFKI

ARC 492 Special Topics in Architecture. *1 3 F.S.* *Sum.* Topics of current interest in Architecture. Normally used to develop new courses.

ARC 494 Internship in Architecture. *Preq: Junior standing in architecture; 3.0 GPA or better; and written approval of department head. 3 6 F.S.* Supervised field experience in architectural offices and organizations. SACCOPOULOS

ARC 495 Independent Study in Architecture. *Preq: Junior standing in architecture; 3.0 GPA or better; and approval of department head. 1 3 F.S.* Special projects in architecture developed under the direction of a faculty member on a tutorial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

ARC 501 Professional Architecture Studio I. *Preqs: BEDA degree or equivalent and CI. 6(0 12). F.S.* Design studio investigations aimed at the development of an understanding of the major issues confronting the contemporary architect and at the expanding of problem-solving abilities in architectural design.

ARC 502 Professional Architecture Studio II. *Preqs: ARC 501, ARC 510, and CI. 6(0-12) F.S.* Design investigations aimed at the development of an understanding of the major issues confronting the contemporary architect and at the expanding of problem solving abilities in architectural design. This is an individualized, final project studio.

ARC 542 Investigations in Recent World Architecture. *Preq: CI. 3(2 1) F.*

ARC 544 Architectural Conservation. *Preq: Advanced undergrad. in DN or grad. standing. 3(3 0) Alt. S.*

ARC 546 Theory of Building Types. *Preq: Two ARC studios. 3(3-0) F.*

ARC 561 The Practice of Architecture. *3(3-0) F.S.*

ARC 562 Project Processes in Architecture. *Preq: Sr. or grad. standing. 3(3-0) S.*

ARC 570 Theory of Urban Form. *Preq: Advanced undergrad. 3(3 0) Alt. F.*

ARC 571 Urban Housing. *Preq: Advanced undergrad. 3(3 0) S.*

ARC 574 Place and Place Making. *Preq: Advanced undergrad. 3(3 0) S.*

ARC 581, 582 Conceptual Issues in Architecture and Design. *Preq: Grad. standing or advanced undergrad. 3(3 0) F.S.*

AGRICULTURAL AND RESOURCE ECONOMICS

ARE 210 Consumer Economics. *3(3 0) S.* Role of the consumer in the modern economy and application of economic concepts to consumer markets and decisions. Economic analysis of homebuying and home finance, credit, life, health, and property insurance, investments, retirement planning, and information collection. Relationship of the macroeconomy to consumer decisions. WALDEN

ARE 212 Economics of Agriculture. *Preq: MA 111. Credit will not be awarded for both ARE 212 and EC 201. 3(3-0) F.S.* Introduction to the functioning of the agricultural economy including the allocation of resources in agricultural production and consumption, relationships between agriculture and other segments of the economy, and current problems within the agricultural sector.

ARE(EC) 301 Intermediate Microeconomics. *Preqs: MA 121 or 131; ARE 212 or EC 201. Credit not allowed for both EC(ARE) 301 and EC(ARE) 401. 3(3 0) F.S. Sum.* Functioning of the market economy; role of prices in determining the allocation of resources; the functioning of the firm in the economy; forces governing the production of economic goods.

ARE 303 Farm Management. *Preq: ARE 212 or EC 201. 3(2-2) F.S.* Analytical and planning techniques applicable to farm business decisions. Economic principles and management concepts such as budgeting, linear programming, accounting and financial management as related to practical problems of organizing and operating a farm business.

HOAG, OLTMANS

ARE 306 Agricultural Law. *Preq: ARE 212 or EC 201. Credit for both ARE 306 and BUS 307 is not allowed. 3(3-0)F.* Legal principles of practical importance in an agricultural setting: the court system; tort, contract and real and personal property law; legal aspects of organizing an agribusiness; environmental and labor regulations affecting agriculture; income and estate taxation of agriculture.

LANDRY

ARE 311 Agricultural Markets. *Preq: ARE 212 or EC 201. 3(3 0) F.S.* Agricultural marketing system and economic forces affecting its structure and efficiency. Public policy issues affecting agricultural markets. Emphasis on the analysis of current sources of agricultural market information. Marketing and storage problems over time; futures markets and the management of risk; transportation and international trade; government agricultural programs.

SCHRIMPER

ARE 312 Agribusiness Marketing. *Preq: ARE 212 or EC 201. 3(3-0) S.* Application of marketing and economic principles to decision making in contemporary agribusiness firms. Marketing strategies, marketing research and information, segmentation and targeting, marketing mix, and market plans within food, fiber, natural resource, and production input industries. Professional selling skills and knowledge. Off-campus field experience and visiting lecturers from the agribusiness industry.

ARE 321 Agricultural Financial Management. *Preq: ARE 212 or EC 201. 3(3 0) F.* Fundamental concepts for financial management decision in agricultural farm businesses. Emphasis on financial statement analysis of profitability, efficiency, liquidity, repayment capacity, risk, leverage, growth. Capital budgeting, investment decisions, farmland bid price determination, farm real estate appraisal. Financial markets and credit institutions serving agriculture, lending policies, loan analysis, interest rate determination. Financial structure, performance, condition of farm sector.

OLTMANS

ARE(EC) 336 Introduction to Resource and Environmental Economics. *Preq: ARE 212 or EC 201. 3(3 0) S.* Application of basic economic tools to understand and evaluate environmental/resource policies. Concepts such as property rights, non-market goods, allocation over time, externalities, and public goods. Current policy issues such as global climate change, evaluating natural resource damages from oil spills, reducing the costs of regulations, protecting estuaries, and dealing with non point source pollution.

ARE(EC) 401 Economic Analysis for Non-Majors. *Preq: ARE 212 or EC 201. Not open to undergraduates majoring in the Department of Agricultural and Resource Economics or the College of Management. Credit not allowed for both ARE(EC) 301 and 401. 3(3 0) F.S.* Intermediate economic theory of firm, household, and market behavior. Demand, production and cost theory, market equilibrium under competitive and non-competitive conditions, and problems of economic efficiency. [ARE(ECG) 501 is primarily for graduate students desiring an economics minor at the master's level. Students completing intermediate microeconomics and calculus should elect ECG 501, Price Theory, instead.]

WALDEN

ARE 403 Economics of Consumer Decisions. *Prereq:* ARE 212 or EC 201. *Not open to undergraduates majoring in the Department of Agricultural and Resource Economics or the College of Management. Credit not allowed for both ARE 210 and ARE 403. 3(3-0) Alt. Sum.* Application of economic theory of the consumer to lifetime personal resource allocation decisions intended for non-major graduate students at the master's level. Emphasis on dynamic considerations in consumption and saving, replacement of consumer durables, and evaluation of consumer protection policies. WALDEN

ARE 423 Futures and Options Markets. *Preqs:* ARE(EC) 301 and ARE 311 or BUS 320. 3(2-2) S. Operation and business uses of futures and options markets. Emphasis on market institutions, arbitrage price relationships, risk analysis, hedging theory and practice, portfolio evaluation and market regulation. Similarities among commodity, bond and stock index futures emphasized. FACKLER

ARE 430 Agricultural Price Analysis. *Prereq:* ARE(EC) 301. 3(3-0) S. Factors influencing agricultural prices and their effects on producers and consumers; analysis of the interrelationship of cash, futures, and option market prices of agricultural commodities and alternative ways in which governmental action effects agricultural prices; development of models for price analysis and forecasting; construction of price indices; and calculation of parity price.

ARE 433 U.S. Agricultural Policy. *Prereq:* ARE(EC) 301 or ARE(EC) 401. 3(3-0) S. Government economic policies and programs affecting agricultural inputs and farm products. Analysis of the rationale, objectives, and major types of agricultural programs and their effects on resource allocation and on income distribution within agriculture and between agriculture and the rest of the economy. HOOVER

ARE(EC) 436 Environmental Economics. *Prereq:* ARE(EC) 301. 3(3-0) S. Use of economics in understanding pollution, congestion, conservation and other environmental problems. Relevant economic tools such as pricing schemes, abatement cost curves, damage functions and benefit-cost analysis. Pollution taxes, regulations and subsidies considered in designing alterations in the incentive system. Public policy alternatives examined in the context of non market decision making. CARLSON, PALMQUIST, SMITH

ARE 492 External Learning Experience. *Prereq:* *Sophomore standing. 1-6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

ARE 493 Special Problems/Research Exploration. *Prereq:* *Sophomore standing. 1-6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

ARE 495 Special Topics in Agricultural and Resource Economics. *Prereq:* *Consent of the Department. 1-6.* Presentation of material not normally available in regular course offerings, or offering of new courses on a trial basis.

ARTS STUDIES

For further information on the courses listed below see the full description under the appropriate prefix: ARC-Architecture, COM Communication, DAN-Dance, DF-Design Fundamentals, DN-Design, GC Graphic Design, ENG English, HA-History of Art, HI History, LAR Landscape Architecture, MDS-Multidisciplinary Studies, MUS-Music, PE-Physical Education, PHI-Philosophy, TED-Technology Education.

Aesthetics

- ARC 445 Aesthetics and Design
- MDS 351 Arts, Ideas, and Values
- MDS 494 Topics in Arts Studies
- PHI 306 Philosophy of Art

Art and Design

- DF 111 Two dimensional Design for Non Design Majors
- DF 112 Three-dimensional Design for Non-Design Majors
- DN 311 Basic Visual Laboratories
- DN 381 Basic Drawing
- DN 384 Basic Painting
- DN 386 Basic Sculpture
- DN 411 Advanced Visual Laboratory
- DN 414 Color and Light
- DN 481 Intermediate Drawing
- DN 484 Intermediate Painting
- DN 486 Intermediate Sculpture
- DN 487 Sculpture: Life Modeling
- LAR 221 Environment and Behavior for Designers
- LAR 222 Perception and Behavior for Designers
- LAR 234 Introduction to Environmental Design
- TED 246 Graphic Arts Technology
- TED 351 General Ceramics

Dance

- DAN 272 Dance Composition
- DAN 295 Problems of Dance Performance
- PE 263 Tap Dance
- PE 273 Jazz Dance
- PE 264 Ballet
- PE 274 Modern Dance I
- PE 275 Modern Dance II

Film Studies

- COM 244 Introduction to Film Production
- COM 364 History of Film to 1940
- COM 374 History of Film from 1940
- DN 316 Film Animation
- ENG 282 Introduction to Film
- ENG 382 Film and Literature
- ENG 492 Special Topics in Film Styles and Genres
- HI 336 America in Movies
- MDS 496 Topics in Film and Interdisciplinary Studies

Multidisciplinary Approaches to Arts Studies

- MDS 327 Modern Art-Modern Literature: 1880-1980
- PRT 365 Arts Management in Recreation

History of Art and Design

- ARC 141 History of Design I
- ARC 142 History of Design II
- ARC 441 History of Contemporary Architecture
- GD 242 History of Graphic Design
- HA 201 History of Art from Ancient Greece through the Renaissance

HA 202	History of Art from the Renaissance through the 20th Century
HA 203	History of American Art
HA 401	19th Century European Art
HA 404	Italian Renaissance Masters
LAR 443	Landscape History
LAR 444	History of Landscape Architecture

Music

MUS 100	Instrumental Music
MUS 101	Beginning Class Piano I
MUS 102	Beginning Class Piano II
MUS 110	Choral Music
MUS 120	Rudiments of Music
MUS 150	String Chamber Music
MUS 200	Understanding Music
MUS 210	A Survey of Music
MUS 215	Music of 17th and 18th Centuries
MUS 220	Music of 19th Century Europe
MUS 230	Introduction to Music Drama
MUS 250	Vocal Techniques
MUS 260	History of Jazz
MUS 300	Chamber Music Performance
MUS 301	Basic Music Theory I
MUS 302	Basic Music Theory II
MUS 305	Introduction to Music Composition
MUS 320	Music of the 20th Century
MUS 340	The Symphony Orchestra and Its Music
MUS 498	Independent Study in Music

Photography

DN 212	Basic Photography
DN 312	Intermediate Photography
HA 310	History of Art and Photography

Theatre

COM 103	Introduction to the Theatre
COM 203	Theory and Practice of Acting
COM 213	Oral Interpretation of Literature
COM 223	Stagecraft
COM 233	Introduction to Stage Lighting
COM 243	African American Theatre
COM 293	Theatre Practicum
COM 303	Stage Directing
COM 313	Advanced Oral Interpretation
COM 323	Introduction to Scenic Design
COM 333	Advanced Acting

Video and Audio

COM 204	Writing for the Electronic Media
COM 214	Introduction to Audio Production
COM 224	Introduction to Television Production
COM 234	Criticism of Entertainment Media
COM 314	Advanced Audio Production
COM 324	Advanced Television Production
COM 334	Criticism of Information Media

COM 354 Portable Video Production
COM 454 Portable Video Practicum

Writing

ENG 288 Fiction Writing
ENG 289 Poetry Writing
ENG 488 Advanced Fiction Writing
ENG 489 Advanced Poetry Writing
ENG 588 Fiction Writing Workshop
ENG 589 Poetry Writing Workshop

AEROSPACE STUDIES (AIR FORCE ROTC)

(Also see MS Military Science; NS Naval Science.)

GENERAL MILITARY COURSES

AS 121 The Air Force Role in the Department of Defense I. 1(1-1) F. Initial course in the four year Air Force ROTC curriculum. Familiarizes student with the mission, organization and doctrine of the U.S. Air Force and U.S. strategic offensive and defensive forces. Laboratory corps training provides experience in drill movement, knowledge of customs and courtesies, information about Air Force career opportunities, and the life and work of the junior officer.

AS 122 The Air Force Role in the Department of Defense II. 1(1-1) S. Continues study of U.S. strategic defensive forces. Familiarizes student with aerospace support forces and U.S. general purpose forces, including those of the Army, Navy and Marines. Corps training stresses fundamentals needed to capably assume and discharge future responsibilities in AFROTC and the U.S. Air Force.

AS 221 The Development of Airpower I. 1(1-1) F. Airpower from the early years of powered flight through World War II. Factors which have prompted research and technological change. Events which show the impact of airpower on strategic thought. Corps training and laboratory provide experiences designed to develop each student's leadership potential and serve as an orientation to active duty.

AS 222 The Development of Airpower II. 1(1-1) S. Airpower from the end of World War II to the present. Emphasis on technological change and the events which show the impact of airpower on strategic thought. Corps training and laboratory provide experiences designed to develop each student's leadership potential and serve as an orientation to active duty.

PROFESSIONAL OFFICER COURSES

AS 321 Air Force Management and Leadership. Preqs: Four year AFROTC Cadet; Satisfactory completion of four-week summer camp. Two-year cadet: Satisfactory completion of six weeks summer camp. 3(3-1) F. A study of management from the point of view of the Air Force junior officer, including the subjects of military leadership and military law. Attention given to progressive development of communicative skills needed by junior officers. Practical experience in advanced military leadership activities.

AS 322 Air Force Management and Leadership II. Preq: AS 321. 3(3-1) S. Class and laboratory study of and practical experience with management functions in the military environment. The planning, organizing, directing, controlling and coordinating functions of management; the command and staff functions in advising, problem solving and decision-making situations. Emphasis on developing communicative skills, leadership abilities and basic knowledge required of an Air Force junior officer.

AS 421 American Defense Policy I. Preq: Satisfactory completion of four or six-week summer camp. 3(3-1) F. The role of national security forces in contemporary American society. The professional military as it relates to the American political and social system.

Formulation of military policy is examined in terms of international and domestic constraints. A treatment of the development of modern defense strategy. The student studies and practices communicative skills. Corps training provides for advanced leadership experience.

AS 422 American Defense Policy II. *Prereq: AS 421, 3(3-1) S.* Continues the study of national security forces in contemporary American society. Focuses on strategy and management of modern conflict and formulation and implementation of U.S. defense policy. Brief study of the Air Force Officer classification and assignment system. Students develop their communicative skills and participate in advanced leadership situations in corps training.

AS 495 Special Topics in Aerospace Studies. *Prereq: CI 2(2 0) F.S.* Offered as needed to treat new or special subject matter relating to the Department of the Air Force.

FIELD TRAINING COURSES

AFROTC field training is offered during the summer months at selected Air Force bases throughout the United States. Students in the four year program participate in four weeks of field training during the summer after their sophomore year. Students applying for entry into the two-year program must successfully complete six weeks of field training prior to enrollment in AFROTC.

Major study areas in the four-week field training program include junior officer training, aircraft and aircrew indoctrination, career orientation, survival training, base functions and Air Force environment, and physical training.

The six-week field training program covers all four week training program areas plus all of the subject matter received by four-year program cadets during their freshman and sophomore years in the General Military Course, including corps training.

BIOLOGICAL AND AGRICULTURAL ENGINEERING

BAE 101 Introduction to Biological and Agricultural Engineering and Computing. *Prereq: MA 141, 4(1) F.* Introduction to Biological and Agricultural Engineering, areas of concentration, and example engineering problems from each area. Introduction to departmental and campus-wide computing facilities. **PARSONS**

BAE 201 Shop Processes and Management. *3(2-3) F.S.* Materials, shop processes, management and safety practices essential to the operation and maintenance of a mechanized farm operation or related agricultural industry. Demonstrations and hands-on practice through laboratory activity. **ROBERSON**

BAE 202 Introduction to Biological and Agricultural Engineering Methods *Prereq: BAE 101, 4(2 4) S.* Problem solving methodology relating to Biological and Agricultural Engineering. Coverage of computer aided engineering graphics, material properties, design, fabrication, and tool processes. **STIKELEATHER**

BAE 211 Farm Machinery. *3(2 3) S.* Operation, maintenance, and adjustment of farm machines. Functional and energy requirements related to economic considerations in ownership and efficient operation. **BAUGHMAN**

BAE 221 Agricultural Systems I: Microcomputer Applications. *Prereq: MA 112 or 114. Credit will not be given for both BAE 221 and BAE 241. 3(1-4) F.S.* Microcomputers and their applications to agricultural systems. Hands on experience with the following software: word processing, electronic spreadsheet, database management and equation solver. Term project. **DONAHUE**

- BAE 222 Agricultural System II: Methodologies and Approaches.** *2(0 4) S.* Systems approaches to complex agricultural situations: entering unstructured situations, expressing a problem situation, formulating root definitions and relevant systems, building conceptual models, comparing models with the real world systems, defining desirable and feasible changes in a system, taking action in problem situations. SOWELL
- BAE 241 Computer Applications in Agriculture and Life Sciences.** *Preq: MA 112 or MA 114, 3(1-4) F.S.* An introduction to electronic digital computers with emphasis on small low-cost computers and their applications in agriculture and life sciences. DONAHUE
- BAE 303 Energy Conversion in Biological Systems.** *Preqs: BS 100; MA 112 or 102; PY 205 or 211, 2(2-0) S.* Energy transformations and exchanges of plants and animals are studied on the basis of physical theories and principles. Discussion of examples in convection, conduction, radiation, phase change, muscle work, photosynthesis, respiration and concentration of solutions. SUGGS
- BAE 311 Agricultural Power and Machinery.** *Preqs: CH 101, PY 211 or 221, BAE 211, 3(2 3) S.* Internal combustion engines, gasoline and diesel. Thermodynamic principles and their application to engine cycles, efficiency, design and operation. Fuel, electrical, cooling, lubrication and other engine systems as needed for practical power production. Power trains and hydraulic systems used on farm tractors.
- BAE (SSC) 323 Water Management.** *Preq: Junior standing, 3(2 2) F.* Water management principles applied to agriculture; hydrologic cycle, runoff, surface and subsurface drainage, soil conservation measures to reduce erosion and sedimentation, irrigation, pond construction, open channel flow, water rights, and environmental laws pertaining to water management. Emphasis on problem solving. SNEED
- BAE (SSC) 324 Elementary Surveying.** *Preq: Junior standing, 1(0 3) F.* Theory and practice of plane surveying to include measuring distances as well as record keeping, differential leveling, profile leveling, topographic mapping, stadia surveying, and the use of these tools in agricultural applications. SNEED
- BAE 331 Agricultural Systems III: Management Techniques.** *Preqs: BAE 221, EB 212, 2(1 2) F.* Techniques of systems analysis including quantitative economics and project management. Emphasis on applications to agriculture and machinery management. SOWELL
- BAE 332 Farm Structures.** *Preq: PY 211 or 221, 3(2-3) S.* Environmental relationships, design methods, materials, construction procedures and layout practices as they relate to current changes in agricultural production techniques. Problem situations relating to farm structures are investigated individually by each student in the laboratory. Emphasis on relating the theory to current applications.
- BAE 333 Processing Agricultural Products.** *Preq: PY 212, 4(3 3).* Application of the principles of fluid flow, heat transfer, refrigeration, psychrometrics, and materials handling to the processing of agricultural products. Pump sizing, heat exchanger selection, refrigeration analyses, fan sizing, crop drying, and selection of materials handling equipment. WILLITS, YOUNG
- BAE 343 Agricultural Electrification.** *Coreq: PY 212 or 221, 3(3 0) F.* Practical and efficient use of electrical energy for agricultural and home application. Energy conservation, electric rates, farm and house wiring, circuit design, single phase and three phase distribution systems, electric motors, lighting, space and water heating, electric controls, safety and protective devices. BAUGHMAN
- BAE 344 Circuits and Controls.** *Coreq: PY 212 or 221; BAE 343 or ECE 211, 1(0 3) F.* Applied laboratory covering energy conservation, farm and home wiring, circuit design, single phase and three-phase distribution systems, electric motors, lighting, heating, electric controls, safety and protective devices, and home water systems. BAUGHMAN
- BAE 361 Analytical Methods in Mechanical Design.** *Preqs: BAE 252, MAE 208, MAE 314, MA 301, 3(2 2) S.* Engineering problem solving through studies of topics in mechanical

design. Topics include kinematic analysis of linkages analysis and design selection of machine structures and power transmission components, including hydraulics.

STIKELEATHER

BAE 401 Instrumentation and Controls for Biological Systems. *Preq: ECE 211, MA 242, MA 341, 3(2-3) F.* Basic concepts of instrumentation for making, measuring and controlling biological systems. Study of transducers and control circuits utilized in biological and agricultural engineering work. Electronic models used to demonstrate concepts of errors, accuracy and precision, linearity and other instrument characteristics. Laboratories provide hands-on experience for reinforcing lecture concepts.

BAE 402 Transport Phenomena. *Preq: MA 341, 3(2-2) F.* Theory and application of heat and mass transfer in biological, food, and agricultural systems. Topics include fluid flow, conduction, convection, radiation, psychrometrics, and refrigeration.

BAE 411 Farm Power and Machinery. *Preqs: CH 101; BAE 211; PY 213 or 221, 3(2-3) S.* Internal combustion engines, gasoline and diesel. Thermodynamic principles and their application to engine cycles, efficiency, design and operation. Fuel, electrical, cooling, lubrication and other engine systems needed for practical power production. Power trains and hydraulic systems used on farm tractors. Farm machinery power management principles.

BOWERS

BAE 422 Introduction to Food Process Engineering. *Preq: BAE 402; MAE 308 or CE 382, 3(2-2) S.* Introductory principles and practices of handling and preserving food products. Coverage includes the design and analysis of handling systems for discrete and continuous flow material handling systems, the selection and specification of automatic controls, food preservation principles and considerations relevant to the design of food handling systems, and the principles and practices of drying and storing grain.

BAE 441 Agricultural Systems IV: Modeling and Analysis. *Preq: BAE 331, ST 361, 3(2-2) F.* Basic concepts and methodology of systems modeling and analysis: linear programming, simulation, and expert systems. Applications to agricultural problems.

BAE 442 Agricultural Systems V: Senior Project. *Preqs: BAE 222, BAE 441, ENG 321, COM 110, 2(0-4) S.* Individual project using systems approaches to address a complex situation or problem in agriculture.

BAE 451 Agricultural Engineering Design I. *Preq: Senior standing. Completion of junior year BAE requirements in SBE SBA curriculum, 4(1-6) F.* Design concepts are applied to current agricultural engineering problems. One major design project is combined with a variety of case studies and short term design problems.

ROHRBACK

BAE 452 Agricultural Engineering Design II. *Preq: BAE 451, 2(0-4) S.* Continuation of BAE 451. The major design problem solution is evaluated under actual problem conditions and the student is required to assess the effectiveness of the design.

ROHRBACK

BAE 462 Machinery Design and Applications. *Preq: BAE 361; Coreq: ST 361, 3(2-3) S.* Machinery design for effective use of energy and labor in agricultural production. Engine cycles, power transmission, hydraulics, traction, combined stresses, finite element analysis, computer aided engineering, and engineering economics. Machinery design of agricultural field equipment and other agricultural machinery systems.

BAE(CHE) 465 Introduction to Biomedical Engineering. *Preqs: MA 202 or MA 212, PY 212 or PY 208, 3(3-0) S.* (See Chemical Engineering)

RICHARDSON

BAE 471 Land Resources Environmental Engineering. *Preq: SSC 200; Coreq: CE 382 or MAE 308, 3(2-2) F.* Hydrology and erosion principles. Designing structures and selecting practices to control land runoff, erosion, sediment pollution and flooding.

BAE 472 Irrigation and Drainage *Preq: SSC 200, BAE 471, 3(3-0) S.* Design, management and evaluation of irrigation and drainage systems; concepts and processes of system design.

BAE 473 Introduction to Surface/Water Quality Modeling. *Preq: SSC 200; Coreq: BAE 471, 3(2-2) S.* Concepts in basic hydrologic, erosion and chemical transport used in

modeling. Evaluation of typical hydrologic water quality models on watershed systems. Project examples using "state-of-the-art models."

BAE 481 Structures & Environment. *Preq: BAE 402; CE 318 or MAE 314, 3(2-3) S.* Principles of environmental control and structural analysis are combined with biological principles for the design of structures. Topics include structural analysis, load estimation, material selection, fasteners, physiological reactions of animals and plants to their environment, applications of heat transfer and psychrometrics in calculating ventilation requirements, heating or cooling loads.

BAE 492 External Learning Experience. *Preq: Sophomore standing, 1-6 F, S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

BAE 493 Special Problems in Biological and Agricultural Engineering. *Preq: Sophomore standing, 1-6 F, S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

BAE 495 Special Topics in Biological and Agricultural Engineering. *Preq: Consent of Instructor, 1-3 F, S, Sum.* Offered as needed to present new or special Biological and Agricultural Engineering subject matter.

Selected 500-Level Courses Open To Advanced Undergraduates

BAE 522 Mechanics of Biological Materials. *Preq: PY 205, BS 100, MA 242, 3(2-2) Alt, F.*

BAE 552 Instrumentation for Agricultural Research and Processing. *Preqs: ECE 331, MA 301, 2(1-3) F.*

BAE (CE, MB) 570 Sanitary Microbiology. *Preq: MB 401 or equivalent, 3(2-3) S.*

BAE (CE) 578 Agricultural Waste Management. *Preq: Grad. or advanced undergrad. standing, 3(2-3) Alt, F.*

BAE (FS) 585 Food Rheology. *Preqs: FS 331 or MAE 314, 3(2-3) Alt, F.*

BAE 590 Special Problems. *Preq: Sr. or grad. standing in biological and agricultural engineering. Credits arranged.*

BIOCHEMISTRY

BCH 150 Introductory Biochemical Concepts. *Preq: Enrollment limited to freshmen and sophomores in BCH; Coreq: CH 101, 2(2-0) S.* An introduction to concepts and perspectives in biochemistry, designed to provide students with an overview of biology at the molecular level. AGRIS

BCH 451 Introductory Biochemistry. *Preq: CH 223, 3(3-0) F, S, Sum.* Introduction to the fundamentals of biochemistry, dealing with the chemistry of living organisms, structures and interactions of biomolecules. HORTON, KNOPP, OTVOS, WOLLENZIEN

BCH 452 Introductory Biochemistry Laboratory. *Coreq: BCH 451, 2(1-3) F, S.* Laboratory experience to complement BCH 451. Basic skills in the use of volumetric equipment, spectrophotometers, chromatography, and electrophoresis. Manipulation and assay of small quantities of biological materials, and analysis of laboratory data. KNOPP

BCH 453 Introduction to Molecular Biology and Metabolism. *Preq: BCH 451. 3(3-0)* S. Introduction to metabolic relationships (including nitrogen and lipid metabolism), molecular biology, and methodologies of recombinant DNA research.

MAXWELL, HASSAN

BCH 492 External Learning Experience. *Preq: Sophomore standing. 1 6 F, S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and academic dean prior to the experience.

BCH 493 Special Problems in Biochemistry. *Preq: Sophomore standing. 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

BCH 495 Special Topics in Biochemistry. *1 5 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

BCH 540 Proteins. *Preq: BCH 451 or equivalent. 2(2-0) F.*

BCH 541 Nucleic Acids. *Preq: BCH 451 or equivalent. 2(2 0) F.*

BCH 542 Metabolism. *Preq: BCH 451 or equivalent. 2(2 0) F.*

BCH 543 Regulation. *Preq: BCH 451 or equivalent. 2(2 0) Alt. S.*

BCH 552 Experimental Biochemistry. *Preq: CH 223; CH 315 recommended; Coreq: BCH 551. 3(1-6) F.*

BCH 590 Special Topics in Biochemistry. *Preq: BCH 451 or equivalent. Credits arranged, maximum 3. F,S,Sum.*

BIOMATHEMATICS

Selected 500-Level Courses Open to Advanced Undergraduates

BMA (BO) 567 Modeling of Biological Systems. *Preq: MA 112. 4(3 2) Alt. yrs.*

BMA (MA,ST) 571 Biomathematics I. *Preq: Advanced calculus, reasonable background in biology or CI. 3(3-0) F.*

BMA (ST, MA) 572 Biomathematics II. *Preq: BMA 571. 3(3 0) S.*

BMA (ST, OR) 575 Decision Analytic Modeling. *Preqs: MA 421 or ST 421 and ST 507 or ST 511 or ST 515.*

BMA 591 Special Topics. *Preq: CI. Maximum 3.*

BOTANY

BO 200 Plant Life. *4(3-3) F,S,Sum.* An introduction to the structure, processes, and reproduction of higher plants, including the diversity of the plant kingdom and principles of inheritance, ecology, and evolution.

STUCKY, VAN DYKE

BO 213 Plants and Civilization. *Preqs: BS 100, BS 105 or BO 200. 3(3-0) S.* Economic social, political, religious, and medical roles of plants and plant products in human civilization. Foods, beverages, drugs, fibers, oils, latexes, religious symbols and elements.

BECKMANN

BO (ZO) 360 Introduction to Ecology. *Preq: A 200 level biology course. 3(3-0) F,S,Sum.* Science of ecology, including factors which control distribution and population dynamics of organisms, structure and function of biological communities, and energy flow and nutrient cycling in ecosystems; contrasts among the major biomes; and principles governing ecological responses to global climatic and other environmental changes.

MOZLEY, WENTWORTH

BO (ZO) 365 Ecology Laboratory. *Coreq: BO (ZO) 360. 1(0-3) F,S,Sum.* Laboratory coordinated with BO (ZO) 360 lecture, illustrates basic principles of environmental measurement, data analysis, limiting factors, adaptation, biogeography, succession, populations, communities, ecosystems, and competition and predation by means of field trips and laboratory experiments.

MOZLEY, WENTWORTH

BO 400 Plant Diversity. *Preq: BO 200. 4(3-3) F.* A comprehensive survey of the vegetative and reproductive diversity of the plant kingdom. Emphasis is placed on evolutionary trends, adaptive strategies, and bases for assumed phylogenetic relationships, considering fossil as well as living forms.

HARDIN

BO 403 Systematic Botany. *Preq: BS 100 or 105 or BO 200. 4(2-4) S.* Systematic survey of vascular plants, emphasizing terminology, family characteristics, field identification, general evolutionary relationships, and mechanisms of plant speciation.

HARDIN

BO 413 Introductory Plant Anatomy. *Preq: BO 200. 4(3-3) S.* Organelles, cells, tissue systems, and organs of flowering plants and selected gymnosperms. Microscope use on fresh, cryostat, and prepared plant sections. Histochemistry of plant cells and tissues.

ANDERSON

BO (ZO) 414 Cell Biology. *Preqs: CH 223, PY 212, ZO 201, or 203. 3(3-0) F.* (See Zoology.)

BO 421 Plant Physiology. *Preqs: BS 100, BS 105 or BO 200; one year of college chemistry. 4(3-3) F,S.* Physiology of higher plants with emphasis on structure function relationships, water and solute relationships, metabolism, photosynthesis, and nutrition. Plant growth and development as influenced by plant growth regulators and environmental factors.

FITES, TROYER

BO 492 External Learning Experience. *Preq: Sophomore standing. 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

BO 493 Special Problems in Botany. *Preq: Sophomore standing. 1-6 F,S.* A learning experience within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

BO 495 Special Topics in Botany. *Preqs: 8 hrs. of Botany courses. 1-6 F,S,Sum.* Individualized study, under faculty supervision, of botanical topics in the student's area of interest and not covered in existing courses. Development of a new course on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

BO 510 Plant Anatomy. *Preq: BO 200. 4(3-3) F.*

BO (CS, HS) 518 Biological Control of Weeds. *Preq: CS 414 or equivalent. 1(1-0) F.*

BO 522 Advanced Morphology and Phylogeny of Seed Plants. *Preq: BO 403. 4(3-3) F. Odd yrs.*

BO 544 Plant Geography. *Preqs: BO 403, BO (ZO) 360, GN 411 or equivalents. 3(3-0) S. Even yrs.*

BO 545 Paleobotany. *Preqs: BO 400, 403, 413, 544, MEA 423 or equivalent. 4(3-3) S. Odd yrs.*

- BO 551 Advanced Plant Physiology I.** *Preqs: BO 421 or equivalent. 3(3-0) F.*
- BO 552 Advanced Plant Physiology II.** *Preq: BO 421 or equivalent and biochemistry. 3(3 0) S.*
- BO 554 Laboratory in Advanced Plant Physiology II.** *Preq. or coreq: BO 552. 1(0-3) S.*
- BO (ZO) 560 Principles of Ecology.** *Preq: Three semesters of college level biology courses. 4(3 3) F.*
- BO 561 Physiological Ecology.** *Preqs: BO 421 and BO (ZO) 560 or equivalent. 4(3 3) S. Odd yrs.*
- BO 565 Plant Community Ecology.** *Preq: BO (ZO) 560 or BO (ZO) 360 or equivalent. 4(3 3) F.*
- BO (MB) 574 Phycology.** *Preq: BS 100 or BO 200. 3(1-4) S. Odd yrs.*
- BO (MB, PP) 575 The Fungi.** *Preq: BO 200 or equivalent. 3(3-0) F.*
- BO (MB, PP) 576 The Fungi Lab.** *Coreq: BO 575. 1(0-3) F.*
- BO 590 Topical Problems.** *Preq: CI. 1 3 F.S.*

BIOLOGICAL SCIENCES

BS 100 General Biology. *Students may not receive credit for both BS 100 and BS 105. 4(3-3) F.S.Sum.* Basic principles and concepts of biology, including the structure and function of cells and organisms, development, heredity, evolution, and ecology.

BECKMANN, FEAVER, HANING, LYTLE, PARKER

BS 105 Biology in the Modern World. *For non-science students. Students may not receive credit for both BS 105 and BS 100. 4(3 3) F.S.* Principles and concepts of biology including cellular structure and function, metabolism and energy transformation, homeostasis, reproduction, heredity, diversity of life, ecology, evolution and animal behavior. Emphasis on human affairs and human examples.

MICKLE

BS 292 Special Topics in Life Science. *Preq: Permission of Instructor. 1 3 F.S.* Special interest courses and trial offerings of new or experimental courses in life science.

BS 491 Seminar on Professional Development in Biological Sciences. *1(1 0) F.* Planning and analyzing strategies for professional development in the biological sciences utilizing discussion, guest lecturers, and field trips to nearby research laboratories and industrial plants. Intended primarily for juniors and seniors in any biological discipline.

LYTLE

BS 492 External Learning Experience. *Preq: Sophomore standing. 1-6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, and the departmental teaching coordinator prior to the experience.

BS 493 Special Problems in Biological Sciences. *Preq: Sophomore standing. 1-6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by the student and approved by a faculty adviser, the prospective employer, and the departmental teaching coordinator prior to the experience.

BS 495 Special Topics in Biology. *1 6 F.S.Sum.* Independent study projects in biology conducted under the supervision of a faculty member and experimental courses in biological science. Student projects to be selected with the assistance of an appropriate faculty member and with the approval of the Coordinator of the Biological Science Program.

Selected 500-Level Courses Open To Advanced Undergraduates

BS 510 Advanced Biology for Secondary Teachers. *Preq:* Two years of college biology, 6(4 6) *Sum.*

BS 590 Special Problems in Biological Instrumentation. *Preq:* *Cl. 1-3 F.S.*

BUSINESS MANAGEMENT

BUS200 Microcomputer Applications for Business. *1(0 2) F.S., Sum. Open to Accounting, Business Management, Economics, and Agriculture and Resource Economics majors only.* Use of microcomputers in business. Applications and exercises using word processing, spreadsheet, and data management software for specific business problems. Integration of software packages to prepare business reports.

BUS 305 Legal and Regulatory Environment. *3(3 0) F.S., Sum.* Introduction to contract, tort, property, and agency law; the judicial system, common law, statutory law, and constitutional law. Review and discussion of the major statutes affecting business including antitrust, securities, employment, labor, environmental, international and product safety laws.

BUS 307 Business Law I. *Preq:* *EC 201 or ARE 212. Credit for both ARE 306 and BUS 307 is not allowed. (3-0) F.S.* The main principles of law affecting the conduct of trade. Main areas of interest: criminal law, tort law, contracts, agency, real and personal property, wills, and estates.

BUS 308 Business Law II. *Preq:* *BUS 307. 3(3 0) F.S.* The main principles of law affecting the conduct of trades and industry, including corporations, partnerships, insurance, government regulation of business, sales, negotiable instruments, and selected transactions. **CARRAWAY, HUGGARD, PEACE**

BUS(EC) 310 Managerial Economics. *Preq:* *EC 201 or ARE 212. 3(3 0) F.S.* Economic principles applied to decision-making in the firm. The relationship between accounting and economic concepts of cost. Pricing for sales within and outside the firm. The consequences for the firm of the competitive economy. The meaning of risk. Decision making under uncertainty. The implications of transactions costs for the organization of firms. **HOLTHAUSEN, MARGOLIS, NEWMARK**

BUS 320 Financial Management. *Preqs:* *EC 201 or ARE 212; ACC 220 or 280. 3(3-0) F.S., Sum.* Financial decision making by businesses, including capital structure and dividend decisions, capital budgeting and working capital management. Basic financial concepts such as risk and return measurement, portfolio theory and the Capital Asset Pricing Model. **JONES, MITCHELL, POINDEXTER**

BUS 330 Human Resource Management. *Preq:* *EC 201 or ARE 212. 3(3 0) F.S.* Issues faced by firms in attracting and maintaining a productive work force. Criteria for decisions by the profit maximizing firm in determining wages, fringe benefits and working conditions. Job safety, on-the-job training, the behavior of unions, and government regulation in the labor market. **ALLEN, DAVIS, FISHER**

BUS 332 Industrial Relations. *Preq:* *EC 201 or ARE 212. 3(3-0) F.S.* The role of collective bargaining in the labor market. Determinants of the pattern of union membership today and its growth rate. The objectives and tactics of both labor and management within public policy guidelines. Analysis of the impact of unions on job security, productivity, and compensation. **FISHER**

BUS 346 International Business. *Preq:* *EC 201. 3(3 0) S.* Principles and conduct of international business. Environment of international trade and finance relevant to international business. Competitive advantages of multinational firms. International management issues in marketing, accounting, taxation, financial management and control, technology transfer, export-import management, and organizational form. Case studies and discussions. **DUTTON**

BUS(ST) 350 Economics and Business Statistics. *Preqs: MA 114; EC 201 or ARE 212. 3(3 0) F.S.* Introduction to statistics applied to economic and business problems. Emphasis on statistical estimation, inference, linear and multiple regression, and analysis of variance. McDERMED, WILSON

BUS 360 Marketing Methods. *Preq: EC 201 or ARE 212. 3(3-0) F.S.* Examination of decisions affecting marketing of goods and services in consumer, industrial and international markets. Emphasis on the role of marketing in a managerial context. Areas studied include: the activities of marketing research, identification of marketing opportunities, and the development of marketing mix strategies including the decisions concerning pricing, distribution, promotion and product design. GERSTNER, HESS, JECK, TANG

BUS (EC) 404 Money, Financial Markets, and the Economy. *Preq: EC 302. 3(3 0) F.S. Sum.* Roles of money, credit, and financial institutions in a market economy. Allocation of credit, the determination of interest rates and security prices, and the activities of the Federal Reserve System. Pricing models. LAPP, PEARCE, POINDEXTER

BUS 405 Regulatory Law. *Preq: EC (ARE) 301. 3(3-0) F.S.* The major statutes regulating business with some policy discussion of the economic costs and benefits of current regulations and proposals for reform. A general introduction to the judicial system, environmental law, securities law, employment law, and product safety. BAUMER, HUGGARD

BUS 420 Financial Management of Corporations. *Preq: BUS 320. 3(3 0) F.S.* Advanced theory and practice of corporate financial management. Techniques for evaluating alternative investment, financing, capital structure, and dividend policy decisions. International aspects of corporate financial management. Use of personal computers in applying financial management theory to common financial problems. AGRAWAL, JONES, MITCHELL

BUS 422 Investments and Portfolio Management. *Preqs: BUS (ST) 350 or ST 311; and BUS 320. 3(3 0) F.S.* Analysis of the investment process, dichotomized into security analysis and portfolio management. Background information on financial assets, securities markets, and risk-return concepts. Analysis of valuation theory and techniques, modern portfolio theory and portfolio performance. AGRAWAL, JONES, WILSON

BUS (EC) 449. International Finance. *Preq: EC 301. 3(3-0) F.S.* International markets and their effects on firms, investors and national economics. Futures and options in foreign exchange, management of foreign exchange risk, exchange rate determination, and macroeconomic policy in an open economy.

BUS 455 Quantitative Methods for Management. *Preqs: EC 201 or ARE 212, and BUS (ST) 350. 3(3 0) F.S. Sum.* Formulation and use of quantitative models in solving management problems. Linear programming, decision theory, and forecasting. Case studies of actual business problems; use of computer software packages.

BUS 462 Marketing Research. *Preqs: BUS 360 or ARE 311; and BUS(ST) 350. 3(3-0) F.S.* The use, collection, organization and analysis of information pertinent to marketing decisions. Use of qualitative and quantitative data in the solution of specific marketing problems. GERSTNER, HESS, TANG

BUS 464 International Marketing. *Preq: BUS 360. 3(3 0) F.S.* Analysis of concepts, issues, and methods involved in marketing of products across national boundaries. Emphasis on distinctive opportunities and constraints in the international environment, international marketing strategies, and international marketing management techniques.

BUS 465 Advertising and Promotion Management. *Preq: BUS 360. 3(3 0) F.S.* Development of advertising theory and exploration of advertising practice. Topics include: advertising and marketing; planning, management and budgeting; strategy development and execution; media strategy and research; advertising research; economics, social and legal issues; promotion strategy; campaign development and presentation. JECK, KIMBROUGH

BUS 480 Business Policy and Strategy. *Preq: BUS 305, 320, 360; BUS (ST) 350. 3(3-0) F.S.* Comprehensive analysis of administrative policy making from the point of view of the general manager. Integration of perspectives from marketing, finance, and other functional areas of management. Use of case analyses and written reports to develop decision skills.

BUS (TAM) 482 Textile Marketing Management. *Preqs: BUS 360, EC(ARE) 301, TMT 380. 3(2-2) F.S.* (See Textile and Apparel Management)

BUS 485 Management Development Seminar. *Preqs: EC 201 or ARE 212. This course may not be used for credit toward a business management minor for any graduate degree. 3(3-0) F.* Emphasis on developing insight into individual management potential and providing guidance and planning for a management career in industry, government services, or as an entrepreneur. Visiting lecturers.

BUS 495 Special Topics in Business Management. *Preq: Consent of Instructor. 1-6.* Presentation of material not normally available in regular course offerings, or offering of new courses on a trial basis.

BUS 498 Independent Study in Business Management. *Preq: Consent of department. 1-6 F.S., Sum.* Detailed investigation of topics of particular interest to advanced undergraduates under faculty direction on a tutorial basis. Credits and content determined by faculty member in consultation with Department Head.

CIVIL ENGINEERING

CE 200 Civil Engineering, Measurements, and Surveys. *Preq: CSC 110. 3(2-3) S.* The elements of plane surveying, topographical surveying, horizontal and vertical curves, construction surveys, earthwork, photogrammetry, property and sub-division surveys, route surveying and state coordinate system. JOHNSTON

CE 213 Introduction to Mechanics. *Coreq: MA 242. Not for CE department majors. 3(3-0) F.S., Sum.* Introductory study of the state of rest or motion of bodies subjected to the action of forces. The nature and properties of force systems, free body diagrams, the concepts of equilibrium, the motion of particles, the role of Newton's laws, the conservation principles in mechanics, and mechanical vibrations.

CE 214 Engineering Mechanics-Statics. *Preq: PY 205; Coreq: MA 242. 3(3-0) F.S., Sum.* Basic force concepts and equilibrium analysis; distributed forces; centroids; moments of inertia; application to structural elements.

CE 215 Engineering Mechanics-Dynamics. *Preq: A grade of C or better in CE 214; Coreq: MA 242. 3(3-0) F.S., Sum.* Kinematics and kinetics of particles; plane kinematics and kinetics of rigid bodies; simple vibrations and selected topics from three dimensional rigid body dynamics, steady and variable mass flow, and orbital motion. ELY, GURLEY

CE 305 Traffic Engineering. *Preq: CE 200. 3(2-2) F.S.* Integrated approach to planning, design, and operation of transportation systems with an emphasis on highway and street systems. Roadway design, traffic operations and performance, and control systems. HUMMER, STONE

CE 313 Mechanics of Solids. *Preq: A grade of C or better in CE 214; Coreq: MA 242. 3(3-0) F.S., Sum.* Elementary analysis of deformable solids subjected to force systems. Concepts of stress and strain; one, two and three-dimensional stress-strain relationships for the linear elastic solid. Statically determinate and indeterminate axial force, torsion and bending members. Stress transformations, pressure vessels, combined loadings. Introduction to column buckling. DOUGLAS, HAVNER

CE 324 Structural Behavior Measurement. *Preq: MAT 200; Coreqs: CE 215, CE 325. 1(0-3) F.S., Sum.* Introduction to experimental techniques: strain measurement in structural members, strain and displacement measurements in frames and trusses, frequency and damping measurements in beams. Where appropriate, experimental results will be applied to theoretical predictions.

CE 325 Structural Analysis. *Preqs: CSC 110 or CSC 111 and CE 313. 3(3-0) F.S., Sum.* Analysis of internal forces of statically determinate trusses, beams and framed structures. Analysis of deformations by methods of virtual work and conjugate beam. Indeterminate structural analysis of trusses, beams and rigid frames by force and displacement methods.
BINGHAM, ELY, SMITH, TUNG

CE 327 Reinforced Concrete Design. *Preqs: CE 325, CE 332. 3(3 0) F.S., Sum.* Behavior, strength, and design of reinforced concrete members subjected to moment, shear, and axial forces. Introduction to the design of reinforced concrete structures.
AHMAD, NAU, SCHULTZ

CE 332 Materials of Construction. *Preqs: MAT 200 and CSC 110 or CSC 111. 3(2-3) F.S., Sum.* Manufacture and properties of mineral and bituminous cements and mineral aggregates. Mechanical properties and durability of portland cement concrete, bituminous mixtures, masonry units, timber products, and miscellaneous construction materials. Materials testing.
KIM, LEMING

CE 342 Engineering Behavior of Soils and Foundations. *Preq: CE 313; Coreq: CE 332. 4(3 2) F.S., Sum.* Soil properties and mechanics of analysis related to engineering behavior of soils. Includes soil identification, classification, index properties, effective stress concepts, settlement analysis, evaluation of shear strength and bearing capacity, and fundamentals of foundation selection and design.
BORDEN, LAMBE, RAHMAN

CE 367 Mechanical and Electrical Systems in Buildings. *Preq: PY 208. 3(3 0) S.* Introduction to mechanical and electrical systems in building construction. Includes HVAC, lighting and electrical systems, focusing on design concepts, equipment application and design of the construction process for modern building systems.
LOMBARDI

CE 375 Civil Engineering Systems. *Preq: CSC 110; Coreqs: MA 341. 3(3 0) F.S.* A broad perspective, systematic approach to civil planning, analysis, evaluation and design for large scale projects in construction, structures, transportation, water resources and other civil engineering areas.
GALLER, McDONALD, BAUGH

CE 381 Hydraulics Systems Measurements Lab. *Coreq: CE 382. 1(0-3) F.S., Sum.* Introduction to experimental techniques for the analysis of hydraulic systems; measurement of viscosity, fluid pressures, velocity distributions, flow rates; investigations into the friction, momentum transfer, and turbulence on fluid flow.

CE 382 Hydraulics. *Preq: CE 215; Coreq: MA 341. 3(3 0) F.S.* Fluid properties; mass, energy and momentum conservation laws; dimensional analysis and modeling; laminar and turbulent flows; surface and form resistance; flow in pipes and open channels; elementary hydrodynamics; fluid measurements; characteristics of hydraulic machines.
FISHER, McDONALD, OVERTON

CE 383 Hydrology and Urban Water Systems. *Preq: CE 382. 3(3 0) F.S.* Engineering hydrology and design of elements of urban water systems. Applications in stormwater collection, channel design, flood control and water supply. Effects of watershed development on quantity and quality of streamflow.
MALCOM

CE 384 Introduction to Environmental Engineering. *Preq: CE 382 or MAE 308. 3(3-0) F.S.* Overview of environmental engineering and manner in which environment is affected by human activity. Physical, chemical, and biological processes for water and wastewater treatment. Municipal solid waste and hazardous waste management, air pollution, environmental chemistry and microbiology.
BARLAZ, LIEHR

CE 400 Transportation Engineering Project. *Preqs: CE 375, CE 406. 3(1 4) S.* Integrated team approach to design of major transportation engineering projects. Professional topics in transportation engineering practice.
HUMMER

CE 406 Transportation Systems Engineering. *Preq: CE 305. 3(3-0) F.S.* Multi-modal transportation systems; railroads, airports, highways, and other modes. Planning, analysis, and design. Fundamental concepts; supply, demand, flows, impacts, and network optimization.
STONE

- CE 420 Structural Engineering Project.** *Preqs: CE 327, CE 375, CE 426. 3(2 2) F.S.* Planning, analysis and design of complete structural systems composed of steel and reinforced concrete. Professional topics in structural engineering practice. NAU, SMITH
- CE 425 Intermediate Structural Analysis.** *Preq: CE 325. 3(3 0) F.S.* A rigorous treatment, at intermediate level, of indeterminate structural analysis. Coverage includes methods for calculating displacements, force and displacement methods of indeterminate analysis, approximate methods of indeterminate analysis, Maxwell-Betti reciprocal theorem, qualitative influence lines, and introduction to structural vibrations. MATZEN
- CE 426 Structural Steel Design.** *Preq: CE 325. 3(3-0) F.S.* Design and behavior of structural steel members and their connections subjected to moment, shear, and axial forces. Introduction to the design of steel structures. NAU, SCHULTZ, SMITH
- CE 428 Structural Design in Wood.** *Preq: CE 325. 3(3-0).* Structural behavior of wood under loads; design of structural elements in wood; mechanical properties of wood fasteners and connections; design projects using clear wood, plywood and glue-laminated wood.
- CE 440 Geotechnical Engineering Project.** *Preq: CE 375; Coreq: CE 443. 3(1 4) F.S.* Integrated team approach to major geotechnical engineering projects involving site selection, analysis and design of foundations and earth structures, establishment of performance criteria, economic analysis, identification of potential construction problems, and matters regarding professional practice and ethics. BORDEN, LAMBE, RAHMAN, WAHLS
- CE 443 Seepage, Earth Embankments and Retaining Structures.** *Preq: CE 342. 3(3 0) F.S.* Review of shear strength concepts; ground water hydraulics; slope stability; lateral earth pressure problems; placement of fills. LAMBE
- CE 463 Construction Estimating, Planning, and Control.** *Preqs: Junior Standing and CSC 110 or CSC 112. 3(2-2) F.* Overview of the construction industry; life cycle of construction projects, work breakdown structure, activity cost and time estimation, computerized planning and scheduling methods, resource leveling, time cost tradeoff; computerized cost estimating, bidding and negotiation strategies; and cost schedule control systems.
- CE 464 Legal Aspects of Contracting.** *Preq: Sr. standing. 3(3 0) F.* Legal aspects of contract documents, drawings and specifications; owner-engineer-constructor relationships and responsibilities; bids and contract performance, Labor laws; governmental administrative and regulatory agencies; torts; business organizations; ethics and professionalism. McCAIN
- CE 465 Construction Equipment and Methods.** *Preq: CE 332 and either CSC 110 or CSC 112. 3(3 0) S.* Study of construction operations as dynamic production processes. Utilization of equipment and other resources to achieve highest levels of productivity, safety, and quality. Covers a wide range of traditional and state of the art construction methods. BERNOLD
- CE 466 Building Construction Engineering.** *Corequisite: CE 327. 3(2 2) F.* Construction processes for buildings and other structures including codes and standards, structural and architectural components and systems, formwork and bracing design, erection and assembly methods. JOHNSTON
- CE 469 Construction Engineering Project.** *Preq: CE 463. Last semester in CEC or CM; Coreq: CE 464. 3(1-6) F.S.* Capstone course involving integrated team approach in the design of the construction process, utilizing computerized tools for cost estimation, planning, scheduling, process design, and management of two construction projects. Each student also selects an individual project. Lecture topics include: ethics, professionalism, marketing, bid presentations, business planning, finance, and other appropriate topics by guest speakers from industry. McCAIN, LOMBARDI
- CE 480 Water Resources Engineering Project.** *Preqs: CE 305, CE 342, CE 375, CE 383; Coreq: CE 484. 3(1 4) F.S.* Engineering design of selected projects in water resources engineering, involving interactions with other CE specialty areas. Project subjects include sitework, floodwater reservoirs, and one selected by the student. Professional topics in water resources engineering practice. BORDEN, MALCOM

CE 484 Water Supply and Waste Water Systems. *Prq: CE 384, 3(3 0) F.* Elements of the design of water supply and wastewater disposal systems. CHAO

CE 487 Introduction to Coastal and Ocean Engineering. *Prqs: Senior standing and CE 382, 3(3 0) S.* Introduction to design and analysis of civil engineering projects in the ocean and along the coastline. Basic wave mechanics, tides, and ocean dynamics as applied to the understanding of coastal erosion control and other marine problems. An optional two day field trip to the North Carolina Outer Banks at a nominal student expense is a regular feature of the course. FISHER

CE 497 Current Topics in Civil Engineering. *Prq: Permission of Instructor, 1 4 F.S., Sum.* Presentation of material not normally available in regular course offerings or offering of new courses on a trial basis. Credits and content determined by faculty member in consultation with the Department Head.

CE 498 Special Problems in Civil Engineering. *Prq: Sr. standing, 1 4 F.S.* Directed reading in the literature of civil engineering, introduction to research methodology, seminar discussion dealing with special civil engineering topics of current interest.

Selected 500-Level Courses Open to Advanced Undergraduates

CE 501 Transportation Systems Analysis. *Prq: CE 406, 3(3 0) F.*

CE 502 Transportation Operations. *Prq: CE 406, 3(3 0) F.*

CE 503 Transportation Design. *Prq: CE 406, 3(2 3) S.*

CE 504 Water Transportation. *Prq: CE 305, 3(3 0) F.*

CE 507 Airphoto Analysis I. *Prq: Sr. standing, 3(2 3) S.*

CE 510 Airport Planning and Design. *Prq: CE 305, 3(3 0) F.*

CE 511, 512 Continuum Mechanics I, II. *Prqs: CE 313 or MAE 314, CE 382 or MAE 308, MAE 301, MA 405, (511) 3(3 0) F; (512) 3(3 0) Alt. S.*

CE 513 Theory of Elasticity I. *Prq: CE 313 or MAE 314, 3(3-0).*

CE 514 Stress Waves. *Prqs: MA 341; CE 313 or PY 411 or MA 401 or MEA 351, 3(3-0).*

CE 521 Advanced Strength of Materials. *Prq: CE 313 or MAE 314, 3(3 0) F.*

CE 522 Elastic Stability. *Prqs: CE 521, MA 341, 405, 3(3-0).*

CE 524 Analysis and Design of Masonry Structures. *Coreq: CE 420, 3(3 0).*

CE 525 Matrix Structural Analysis. *Prq: CE 425, 3(3-0) F.*

CE 526 Finite Element Methods for Civil Engineering. *Prqs: CE 525 and prior programming knowledge, 3(3 0) S.*

CE 527 Analysis and Design of Structures for Dynamic Loads. *Prq: CE 525, 3(3 0) F.*

CE 531 Structural Models. *Prq: CE 420, 3(2 3) F.*

CE 534 Plastic Analysis and Design. *Prq: CE 420, 3(3 0) S.*

CE 536 Theory and Design of Prestressed Concrete. *Coreq: CE 420, 3(3-0) F.*

CE (MEA) 541 Gravity Wave Theory I. *Prq: MAE 308 or PY 411, 3(3-0) S.*

CE 544 Foundation Engineering. *Prq: CE 342, 3(3 0) S.*

CE 548 Engineering Properties of Soils I. *Prq: CE 342, 3(2-3) F.*

CE 551 Theory of Concrete Mixtures. *Prq: CE 332, 3(3 0) F.*

CE 553 Asphalt and Bituminous Materials. *Prq: CE 332, 3(2-3) S.*

CE 555 Highway and Airport Pavement Design. *Prq: CE 406 or 443, 3(2-3) F.*

CE 561 Construction Planning and Scheduling. *Prq: CE 463, 3(3-0) Every 3rd semester.*

- CE 562 Construction Productivity.** *Preq: CE 463 or equivalent. 3(3 0) Every 3rd semester.*
- CE 566 Building Construction Systems.** *Preq: CE 466 or CE 420 or grad. standing in ARC. 3(3 0). Every 3rd semester.*
- CE (BAE, MB) 570 Sanitary Microbiology.** *Preq: MB 401 or equivalent. 3(2-3) S.*
- CE 575 Civil Engineering Systems.** *Preq: MA 405. 3(3-0) S.*
- CE 580 Flow in Open Channels.** *Preq: CE 382. 3(3 0) F.*
- CE 582 Coastal Hydrodynamics.** *Preq: CE 382 or equivalent. 3(3 0) F.*
- CE 583 Engineering Aspects of Coastal Processes.** *Preq: CE 382 or equivalent. Coreq: MEA (CE) 541. 3(3-0) S.*
- CE 584 Hydraulics of Ground Water.** *Preq: CE 382 or 342 or equivalent. 3(3-0) F.*
- CE 585 Urban Stormwater Management.** *Preq: CE 383. 3(3-0) F. Alt. yrs.*
- CE 586 Engineering Hydrology.** *Preq: CE 383. 3(3 0) F. Alt. yrs.*
- CE 589 Special Topics in Civil Engineering.** *3(3 0) F,S.*
- CE 591, 592 Civil Engineering Seminar.** *1(1 0) F,S.*
- CE 598 Civil Engineering, Projects.** *1-6 F,S.*

FOREST RESOURCES

CFR 110-111 Forest Resources Scholars Forum. *Enrollment limited to participants in the Scholars Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern. WELLMAN

CFR 134 Computers in Natural Resources. *Freshmen and first semester transfer students only. 1(0-3) F,S.* Forestry, wood science, recreation, and natural resource computer applications and exercises using word processing, spreadsheets, and database management programs. Introduction to microcomputer operating systems, specific application packages, and BASIC computer language. ROISE, STAFF

CFR 210-211 Forest Resources Scholars Forum. *Enrollment limited to participants in the Scholars Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern. WELLMAN

CHEMISTRY

CH 100 Chemistry and Society. *4(4 0) F,S,Sum.* Credit is not allowed for CH 100 if student has prior credit for CH 101. Awareness and understanding of chemistry in every day life for the non-science student. Non-mathematical treatment of essential fundamental concepts. Emphasis on practical applications of chemistry to consumer affairs, energy, medicine, food, sports, and pollution.

CH 101 General Chemistry I. *Preq: Satisfactory score on Math Placement Exam or MA 111 with a grade of C or better; Coreq: CH 121. 3(3 0) F,S,Sum.* Fundamental chemical concepts of composition and stoichiometry; atomic structure; bonding and molecular structure, and geometry; chemical reactions; states of matter, including solutions. May be followed by CH 103,105, or 107.

- CH 106 Computer Applications in Chemistry I.** *Preq:* CH major; *Coreq:* CH 101, 1(0 3) F. A supplement to CH 121 laboratory, for chemistry majors. An introduction to the use of computers in chemistry for data analysis, graphical data display, report preparation, and bibliographic searching.
- CH 107 General Chemistry II.** *Preq:* CH 101 with a grade of C or better; *Coreq:* CH 127, 3(3 0) F, S, Sum. Detailed quantitative aspects of solutions, thermodynamics, kinetics, equilibrium, solution stoichiometry, electrochemistry, and acid-base chemistry.
- CH 108 Computer Applications in Chemistry II.** *Preqs:* CH 106, CH major; *Coreq:* CH 107, 1(0 3) S. A supplement to CH 127 laboratory, for chemistry majors. The use of computers in mathematical modeling of chemical concepts; applications of computer graphics to structure drawing, molecular modeling, and scientific illustration.
- CH 121 General Chemistry I Lab.** *Coreq:* CH 101, 1(0 3)
- CH 127 Principles of Chemistry Lab.** *Coreq:* CH 107, 1(0-3).
- CH 211 Analytical Chemistry I.** *Preq:* CH 108; *Coreq:* CH 212 and PY 208. *Credit not allowed for both CH 211 and CH 315.* 3(3 0) S. Methods of quantitative analysis based on solution chemistry, potentiometry, coulometry, chromatography, and molecular absorption and fluorescence spectroscopy. Statistics of measurement precision.
- CH 212 Analytical Chemistry Laboratory I.** *Coreq:* CH 211, 1(0 3) S. Laboratory experiments in volumetric analysis, ion selective electrodes, potentiometry, molecular absorption and fluorescence spectroscopy, acid base chemistry, and computer applications. Precision, accuracy, and statistical analysis emphasized.
- CH 220 Introductory Organic Chemistry.** *Preqs:* CH 107. *Credit is not allowed for both CH 220 and CH 221.* 4(3-3) F, S, Sum. A one semester course in the fundamental principles of organic chemistry. Preparation, reactions, and physical properties of alkanes, cycloalkanes, alcohols, alkyl halides, aromatic compounds, aldehydes, ketones, organic acids, acid derivatives, and amines.
- CH 221 Organic Chemistry I.** *Preq:* CH 107. *Credit is not allowed for both CH 220 and CH 221.* 4(3 3) F, S, Sum. First half of two semester sequence in the fundamentals of modern organic chemistry. Structure and bonding, stereochemistry, reactivity and synthesis of carbon compounds. Detailed coverage of aliphatic hydrocarbons, alcohols, ethers, and alkyl halides. Introduction to spectral techniques.
- CH 223 Organic Chemistry II.** *Preq:* CH 221, 4(3-3) F, S, Sum. Second half of a two-semester sequence in modern organic chemistry. Continuation of mechanistic approach to reactions and synthesis of organic compounds. Detailed coverage of carbonyl compounds (aldehydes, ketones, acids), aromatic chemistry and amines. Spectral techniques employed throughout.
- CH 295 Special Problems in Chemistry.** *Preq:* Consent of Department. 1 3 F, S. Special topics in chemistry at the early undergraduate level. Trial offerings of new or experimental courses in chemistry.
- CH 315 Quantitative Analysis.** *Preqs:* CH 107. *Credit is not allowed for both CH 211 and CH 315.* 4(3-3) F, S, Sum. Fundamental principles and modern techniques of chemical analyses: spectrochemical, electrochemical, and volumetric methods of analysis, modern chemical instrumentation, and interpretation of data.
- CH 331 Introductory Physical Chemistry.** *Preqs:* CH 107 127; MA 241 or 212, PY 205 or PY 211 or PY 221. 4(3 3) F, S. Basic physicochemical principles including chemical thermodynamics, physical and chemical equilibrium, electrochemistry and reaction kinetics. For students who require only a single semester of physical chemistry.
- CH 401 Systematic Inorganic Chemistry I.** *Coreq:* CH 431 or CH 331, 2(2 0) F, S, Sum. Descriptive chemistry of the elements with particular attention to their reactions in aqueous solution. Emphasis on the chemistry of the main group elements and the periodicity of their chemical properties.

CH 402 Inorganic Chemistry Laboratory. *Coreq: CH 401. 1(0-3) F,S.* A laboratory program to accompany CH 401, for B.S. chemistry majors. Synthetic techniques including inert atmosphere, electrolysis, high-temperature, and ion-exchange illustrated by application to main-group and transition metal complexes and to other main-group compounds.

CH 403 Systematic Inorganic Chemistry II. *Preq: CH 401. 3(3 0) S.* Development and application of theoretical principles to the structure and energies of inorganic substances. Particular attention to the chemistry of coordination compounds of the transition elements.

CH 415 Analytical Chemistry II. *Preq: CH 211; Coreq: CH 416, CH 433. 3(3 0) F.* Methods of quantitative analysis based on electronic instrumentation. Signal processing and electronics, spectroscopy (atomic, x-ray fluorescence, infrared Raman, surface), voltammetry, chromatography (gas, liquid), mass spectrometry as well as chemical transducers and statistical methods of data handling.

CH 416 Analytical Chemistry Laboratory. *Coreq: CH 415. 2(0 6) F.* Experiments in spectroscopy, electrochemistry, chromatography and electronics; computer applications to experimental design and data smoothing.

CH 428 Qualitative Organic Analysis. *Preq: CH 223. 3(1 6) F,S.* Introduction to the systematic identification and separation of organic compounds by the application of both physical and chemical techniques. Infrared and nuclear magnetic spectroscopy, chemical classification tests, and the preparation of derivatives are used to acquaint the student with organic research methods.

CH 431 Physical Chemistry I. *Preqs: CH 107, MA 242, PY 203 or 208; Coreq: MA 341. 3(3-1) F,S,Sum.* An intensive study of physical chemical principles including states of matter, classical thermodynamics, physical and chemical equilibria, and electrochemistry.

CH 433 Physical Chemistry II. *Preqs: CH 431, MA 341. Credit may not be claimed for both CH 433 and CH 437. 3(3-1). F,S,Sum.* An intensive study of physical chemical principles including molecular spectroscopy, statistical thermodynamics, reaction kinetics, kinetic theory, and transport properties.

CH 434 Physical Chemistry Laboratory. *Preq: CH 431; Coreq: CH 433. 3(1-4)F,S.* A project-oriented course to acquaint students with modern physical chemistry laboratory techniques. Experiments in chemical thermodynamics, kinetics, molecular structure and spectra.

CH 435 Introduction to Quantum Chemistry. *Preqs: MA 341; PY208 or PY203. 3(3-0) F.* An introduction to the basic principles of quantum theory and its application to atomic and molecular structure and spectroscopy.

CH 437 Physical Chemistry for Engineers. *Preqs: PY 208, CHE 315, MA 341. Credit may not be claimed for both CH 433 and CH 437. 4(4 0) F,S.* Selected physiochemical principles including quantum theory, statistical thermodynamics, kinetic theory, transport phenomena and rates of chemical reactions.

CH (TC) 461 Introduction to Fiber-Forming Polymers. *Preq: CH 223. 4(3 3) F.* (See Textile Chemistry.)

CH 491 Honors Chemistry. *Preq: Senior in Chemistry and admission to Honors Program. 1-3 F,S.* Independent study and research projects in chemistry. Honors students must register for this course in both fall and spring semesters of their senior year.

CH 495 Special Topics in Chemistry. *Preq: Cl. 1-3 F,S.* To serve needs not covered by existing courses.

CH 499 Undergraduate Research in Chemistry. *Preq: Two years of chemistry and departmental approval. Credits Arranged. 1 3 F,S,Sum.* Independent investigation of a research problem under the supervision of a chemistry faculty member.

Selected 500-Level Courses Open To Advanced Undergraduates

CH 501 Advanced Inorganic Chemistry I. *Preq: CH 433. 3(3-0) F.*

CH 503 Advanced Inorganic Chemistry II. *Preq: CH 501. 3(3 0) S.*

- CH 505 **Physical Methods in Inorganic Chemistry.** *Preq: CH 501. 3(3 0) S.*
- CH 511 **Advanced Analytical Chemistry I.** *Preq: CH 433; CH 415. 3(3-0) F.*
- CH 513 **Advanced Analytical Chemistry II.** *Preq: CH 511. 2(2-0) S.*
- CH 514 **Electronics and Instrumentation Laboratory.** *Preq: CH 511; Coreq: CH 513. 1(0 3) S.*
- CH 521 **Advanced Organic Chemistry I.** *Preqs: CH 223, 433 or 435. 3(3 0) F.*
- CH 523 **Advanced Organic Chemistry II.** *Preq: CH 521. 3(3 0) S.*
- CH 525 **Physical Methods in Organic Chemistry.** *Preqs: CH 223 and 433 or 435. 3(3-0) S.*
- CH 527 **Mass Spectrometry.** *Preq: CH 433. 3(3 0) F.*
- CH 531 **Chemical Thermodynamics.** *Preqs: CH 433, MA 341. 3(3 0) F.*
- CH 533 **Chemical Kinetics.** *Preqs: CH 433, MA 341. 3(3 0) Alt. S.*
- CH 535 **Surface Phenomena.** *Preqs: CH 433, MA 341. 3(3-0) Alt. S.*
- CH 536 **Chemical Spectroscopy.** *Preq: CH 435. 3(3 0) Alt. S.*
- CH 537 **Quantum Chemistry.** *Preqs: MA 341, CH 435 or PY 407. 3(3-0) S.*
- CH 539 **Colloid Chemistry.** *Preq: CH 220, 315 or 331, or Cl. 3(2-3) Alt. S.*
- CH(TC) 562 **Physical Chemistry of High Polymers-Bulk Properties.** *Preq: CH 220 or 223, CH 331 or 431. 3(3 0) F.*

CHEMICAL ENGINEERING

CHE 205 Chemical Process Principles. *Preqs: C or better in MA 241, PY 205, CH 107; Coreq: CSC 112. 4(3 2) F.S.* Engineering methods of treating material balances, stoichiometry, phase equilibrium calculations, thermophysics, thermochemistry and the first law of thermodynamics. Introduction to computers and a computer language for solving problems related to the course material. Initial stages of process design through a comprehensive case study.

CHE 225 Chemical Process Systems. *Preq: C or better in both CHE 205 and MA 242, CSC 112. 3(2 2) S.Sum.* Introduction to methods of measuring chemical variables, analyzing process data, and formulating mathematical models of process systems. Instrumental measurement methods. Elementary statistical data analysis. Dynamic process system behavior. Computer simulation of steady-state and dynamic processes.

CHE 311 Transport Processes I. *Preqs: C or better in both CHE 225 and MA 341. 3(3-0) F.S.* Fundamental aspects of momentum and heat transfer, and the use of these fundamentals in solving problems in transport operations.

CHE 312 Transport Processes II. *Preq: C or better in CHE 311. 3(3 0) F.S.* Fundamental aspects of mass transfer and the use of these basic principles in solving problems in transport operations.

CHE 315 Chemical Process Thermodynamics. *Preqs: C or better in CHE 225. 3(3 0) F.S.* Laws of thermodynamics and their application to chemical engineering problems, both in theory and in practice. Criteria of equilibrium in physical and chemical changes. Behavior of real fluids, including mixtures.

CHE 316 Thermodynamics of Chemical and Phase Equilibria. *Preq: C or better in CHE 315. 3(3 0) F.S.* Systematic study of chemical reaction equilibria and phase equilibrium. Use of fugacity, activity and chemical potential concepts for predicting the effect of such variables as temperature, pressure on equilibrium compositions. Methods for measuring and estimating thermodynamic properties important to equilibrium calculation in real systems.

CHE 330 Chemical Engineering Lab I. *Preq: CHE 311. 2(0-4) F,S, Sum.* Laboratory experiments in unit operations of heat transfer and fluid flow. Experimental planning and technical report writing are emphasized.

CHE 331 Chemical Engineering Lab II. *Preq: CHE 312, CHE 330. 2(0 4) F,S, Sum.* Laboratory experiments in mass transfer and reaction kinetics. Experimental planning, technical report writing and oral presentations are emphasized.

CHE 425 Process System Analysis and Control. *Preq: CHE 312. 3(3 0) S.* Dynamic analysis and continuous control of chemical engineering processes. Process modeling; stability analysis, design and selection of control schemes. Solution of differential equations using Laplace transform techniques.

CHE 446 Design and Analysis of Chemical Reactors. *Preq: CHE 316; Coreq: CHE 316. 3(3-0) F.* Characterization and measurement of the rates of homogeneous and heterogeneous reactions. Design and analysis of chemical reactors.

CHE 450 Chemical Engineering Design I. *Preq: CHE 312. 3(3-0) F.* Applications of cost accounting, cost estimation for new equipment, manufacturing cost and measures of profitability. Use of computer simulation design and cost programs. Procedures for sizing unit operations commonly encountered in the chemical process industry. Heuristics for selection of separation processes and heat exchanger network synthesis.

CHE 451 Chemical Engineering Design II. *Preqs: CHE 450, CHE 446. 3(2 2) S.* Chemical process design and optimization. The interplay of economic and technical factors in process development, site selection, project design, and production management. Comprehensive design problems.

CHE (BAE) 465 Introduction to Biomedical Engineering. *Preqs: MA 202 or MA 212, PY 208 or PY 212. 3(3-0) S.* An introduction to certain engineering concepts and to their quantitative application to biomedical problems, such as flow in the cardiovascular and respiratory systems, transfer of materials through physiological tissues and membranes, and performance of organ replacement and assist devices.

CHE 495 Seminar in Chemical Engineering. *Coreq: Senior standing. 1(1 0) F,S.* Professional aspects and topics of current interest.

CHE 497 Chemical Engineering Projects I. *Preqs: Senior standing. 3(0 12) F,S,Sum.* Introduction to chemical engineering research through experimental, theoretical and literature studies. Oral and written presentation of reports.

CHE 498 Chemical Engineering Projects II. *Preqs: Senior standing. 1 3 F,S,Sum.* Projects in research, design or development in various areas of chemical engineering.

Selected 500-Level Courses Open To Advanced Undergraduates

CHE 511 Chemical Engineering Process Modeling. *Preqs: CHE 311, MA 341. 3(3-0) F.*

CHE 513 Thermodynamics I. *Preq: CHE 316. 3(3-0) F.*

CHE 515 Transport Phenomena. *Preq: CHE 311. 3(3 0) F.*

CHE 517 Chemical Reaction Engineering. *Preq: CHE 446. 3(3-0) S.*

CHE 521 Separation Processes. *Preq: CHE 312. 3(3-0) S.*

CHE 525 Chemical Process Control. *Preq: CHE 425. 3(3-0) S.*

CHE (OR) 527 Optimization of Engineering Processes. *Preqs: CHE 451 or OR 501, FORTRAN programming. 3(3-0) F.*

CHE 543 Technology of Polymers. *3(3 0) S.*

CHE 551 Biochemical Engineering. *Preqs: CHE 312, 446. 3(3-0).*

CHE (TC) 569 Polymers, Surfactants and Colloidal Materials. *Preqs: CHE 316, CH 223. 3(3-0) F.*

COMPARATIVE LITERATURE

CL 495 Special Topics in Comparative Literature. 3(3 0) S. Detailed investigation of a topic in comparative literature. Topic and mode of study determined by faculty member(s) in consultation with Comparative Literature Committee and heads of departments of English and Foreign Languages.

COMMUNICATION

COM 103 Introduction to the Theatre. 3(3 0) F,S,Sum. Artistic, technical, historical, and literary areas of theatre, including acting, directing, design, stagecraft, lighting, costuming, makeup, and criticism.

COM 110 Public Speaking. 3(3-0) F,S,Sum. Research skills, topic selection, speech organization, skills in speech delivery. Listening for analysis and evaluation of in-class speech presentation.

COM 112 Interpersonal Communication. 3(3 0) F,S,Sum. Interpersonal communication competence: self concept, self-disclosure, active listening, verbal and nonverbal communication, conflict management, and communication change.

COM 146 Business and Professional Communication. *Communication majors may not count COM 146 in the major.* 3(3 0) F,S. The nature of communication theory and practice in business and professional settings. Development of individual, dyadic, group and organizational communication proficiencies. Supervisory subordinate and peer communication, active listening, group communication, and presentational speaking.

COM 190 Introduction to Communication. *Prereq: COM majors only.* 3(3 0) F,S. Communication theories, practices, and ethical issues related to the five concentrations of study offered by the Department of Communication: Communication (LCC), Communication Disorders (LCD), Mass Communication (LCM), Public Relations (LCP), and Theatre (LCT).

COM 201 Persuasion Theory. 3(3 0) F,S,Sum. Impacts of persuasive communication on attitudes and behavior. Uses humanistic and social scientific theories to explain the persuasive process.

COM 202 Group Communication. 3(3-0) F,S. Group communication in business, industry, government, and education. Elements of decision making, leadership, managing conflict, and facilitating productive membership.

COM 203 Theory and Practice of Acting. 3(3 0) F,S,Sum. Basic contemporary theories on acting, with practical application through classroom exercises. Role analysis, adaptation of voice and body to performance demands, and role development through various rehearsal activities.

COM 204 Writing for the Electronic Media. 3(3-0) F,S,Sum. Theory and practice of writing for radio, television, and film. Students create scripts, treatments, and storyboards. Areas of study include news, documentary, instructional, corporate, promotional, and dramatic approaches to scriptwriting.

COM 211 Argumentation and Advocacy. 3(3 0) F,S. A study of the process of influencing opinion through the use of logical arguments. Emphasis upon analysis, briefing, evidence, reasoning, and refutation. In class debating.

COM 212 Interracial Communication. *Prereq: CI.* 3(3 0) F. Human communication in interracial contexts, with special emphasis on African American and white American communication. Self awareness and self disclosure of racial attitudes and behaviors. Individual and group exercises and presentations.

- COM 213 Oral Interpretation of Literature.** *3(3 0) F,S.* Selection, preparation, and oral performance of literature for specific audiences of adults and children.
- COM 214 Introduction to Audio Production.** *Preq: COM 204. Preference is given to Communication majors. 3(1 4) F,S,Sum.* Basic principles of audio production, including studio operation, performing, writing, and producing.
- COM 215 Introduction To Communication Disorders.** *3(3-0) F,S.* Normal speech language development including the anatomical and physiological bases for reception and expression of oral language. Developmental and acquired speech language problems and basic treatment principles applied to communication disorders.
- COM 223 Stagecraft.** *3(3-0) F, S.* Fundamentals of scenery design, set construction, and related technical activities. Practical applications with use of design media and shop facilities. Required production participation in University Theatre presentations.
- COM 224 Introduction to Television Production.** *Preq: COM 204. Enrollment preference is given to Communication majors. 3(1-4) F,S.* Basic techniques of television studio production, including producing, writing, and directing.
- COM 226 Introduction to Public Relations.** *3(3 0) F,S.* Public relations as a communication function of organizations. Public relations process, principles, history, and practice. Analysis of environmental, organizational, communication, and audience influences on public relations practice; career opportunities.
- COM 233 Introduction to Stage Lighting.** *3(2 2) F.* Fundamentals and uses of stage lighting equipment and stage lighting design. Practical application of design media and shop facilities. Participation in production activity for University Theatre presentations.
- COM 234 Criticism of Entertainment Media.** *3(3 0) F.* Examines the history and impact of media entertainment programming. Television is the central focus but film, radio and print are included. Provides awareness of the evolution of contemporary entertainments and skills of isolating and assessing impact.
- COM 243 African-American Theatre.** *3(3-0) S.* African-American dramaturgy and its impact on the American theatre; plays from the nineteenth century to the present.
- COM 244 Introduction to Film Production.** *3(2-2) F.* Principles of production and editing techniques for 8mm and 16mm film including film stocks, cinematography, camera and lens operation, editing and splicing, the laboratory, scripting, and the film business. Students will script, shoot, and edit short films.
- COM 284 Introduction to Mass Communication.** *3(3-0) F.* Development, structure, and functions of radio, television, film, books, newspapers, magazines and other mass media in the United States. Fundamentals of news, mass entertainment, advertising, public relations and mass communication research.
- COM 293 Theatre Practicum.** *1-6 F,S,Sum.* Practical experience in one or more of the various areas of artistic and technical theatre through active participation in Thompson Theatre's play production program.
- COM 298 Special Projects in Communication.** *1 3 F,S.* A special projects course to be utilized for guided research or experimental classes at the sophomore level, topic determined by instructor.
- COM 301 Presentational Speaking.** *Preqs: COM 110 or COM 146. 3(3 0) F,S.* Design, organization and delivery of oral presentations for policy determination, policy implementation, and sales.
- COM 302 Managing Meetings.** *3(3-0) F.* Rules and customs of meetings in committees, assemblies and organizations; meeting management and group leadership; parliamentary motions and strategies.
- COM 303 Stage Directing.** *3(3 0) S.* Basic theory of directing and its application to theatrical production. Play reading, evaluation, casting procedure, staff organization, and rehearsal planning and practices. Laboratory productions of short plays.

- COM 312 Patterns of Miscommunication.** *3(3-0) F.S.* Miscommunication patterns originating from fallacious semantic assumptions held by communicators. Suggestions for preventing miscommunication.
- COM 313 Advanced Oral Interpretation.** *Prereq: COM 213. 3(1 4) S. Alt. yrs.* Increases skills in selection, preparation, and oral presentation of literature for specific audiences of local elementary and or secondary school pupils.
- COM 314 Advanced Audio Production.** *Prereq: COM 214. Enrollment preference to Communication majors. 3(1 4) S.* Advanced multichannel techniques for audio production. Studio acoustics, audio signal processing, and advanced microphone techniques, writing, and performing.
- COM 315 Phonetics.** *3(3 0) S.* Articulatory and acoustic phonetics; application of the International Phonetic Alphabet with vocal and ear training.
- COM 321 Survey of Rhetorical Theory.** *Prereq: COM 201. 3(3-0) F.* Principles of rhetorical theory from its classical origins through the modern period to the present time. Key concepts and theories that provide a critical understanding of the processes of persuasive symbol use.
- COM 322 Nonverbal Communication.** *Prereq: COM 112. 3(3-0) F. S.* Theory and research in nonverbal communication, including: environment; space; physical appearance; movement; eyes and facial expressions; and vocal cues. Nonverbal communication in personal, workplace and cross-cultural setting.
- COM 323 Introduction to Scenic Design.** *Prereq: COM 103 or 223. 3(2 2) S. Alt. yrs.* Aesthetics, elements, and principles of scenic design. Theories and applications to the physical stage in relation to the script. Practical applications with the use of design media in University Theatre productions.
- COM 324 Advanced Television Production.** *Prereq: COM 224. 3(1 4) S.* Television program production utilizing advanced production techniques. Emphasis on refinement of writing, producing, and directing skills through work in TV studio on production of sophisticated program formats.
- COM 325 Anatomy and Physiology of Speech.** *3(3 0) F.* Anatomy and physiology of the speech mechanism including the muscular, skeletal, and nervous system structures involved in respiration, phonation, and articulation.
- COM 326 Public Relations Applications.** *Prereq: COM 226. 3(3-0) F.S.* Management of the public relations function in organizations and public relations counseling; communication theory and nature of materials emanating from public relations departments and counseling firms, practical analysis and development of public relations publicity and campaigns.
- COM 332 Relational Communication.** *Prereq: COM 112. 3(3 0) F.S.* Communication patterns in the development and deterioration of interpersonal relationships. Functional and dysfunctional communication behaviors in family relationships.
- COM 333 Advanced Acting.** *Prereq: COM 203 or demonstrated competence in acting. 3(3 0) S. Alt. yrs.* Advanced methods in role preparation through exercises in concentration, imagination, sensory and emotional recall, and other Stanislavskian techniques. Analyses and critiques of plays and in-class performances.
- COM 334 Criticism of Information Media.** *Prereq: COM 234 or junior standing. 3(3-0) S.* History and impact of informational and persuasive telemediated messages. Topics addressed include credibility and motivation in local and national news media, persuasion in political campaigns and social movements, art and artifice in commercials, the infusion of entertainment elements into informational programs.
- COM 335 Language Development.** *3(3 0) F. Alt. Yrs.* Syntactic, semantic, morphologic, and pragmatic development from birth through adolescence. The influence of cognitive and social development on language development. First language acquisition versus second language learning.

COM 336 Communications Techniques for Public Relations. *Prq: COM 226. 3(3-0)F.* Communication processes and procedures of public relations programs. Media techniques, preparation of materials, channels of distribution.

COM 342 Interviewing. *Prq: Junior standing. 3(3-0) F,S.* Theory and practice of effective communication skills applied in various types of professional interviews. In class interviewing.

COM 345 Delayed Speech and Language Development. *Prq: COM 335. 3(2 2)S.* Study of delayed speech and language development. Focuses on: mental retardation; central nervous system and emotional disorders; hearing loss; speech deprivation; voice; stuttering; and articulation. Requires field observation.

COM 354 Portable Video Production. *Prq: COM 204. 3(2 2) F,S,Sum.* Principles of producing, directing, and editing techniques for video. Students will script, storyboard, shoot and edit short video projects.

COM 362 Male/Female Communication. *Prq: Junior Standing; COM 112. 3(3 0) F,S.* Effects of gender on the interpersonal communication process. Explanations of gender differences, communication about women and men via language and via media, and interpersonal communication between men and women. Individual and group research; oral presentations.

COM 364 History of Film to 1940. *Prq: Junior standing. 3(3-0) F.* Technological developments and aesthetic movements that shaped cinema production and direction from the beginning of the industry to 1940. Evolution in camera movement, editing, sound, storyline, and the documentary. Rise to prominence of the Hollywood studio systems and the contributions of foreign filmmakers.

COM 374 History of Film From 1940. *Prq: Junior standing. 3(3-0) S.* Technological developments and aesthetic movements that have shaped cinema production and direction from 1940 to the present. Evolution in camera movement, editing, sound, storyline, and the documentary. Post war decline and re-emergence of the Hollywood film industry and the contributions of foreign filmmakers.

COM 390 Seminar in Communication. *Prq: 15 hours of COM courses, Communication majors only. 1(1 0) F,S.* Examination of postgraduate plans for employment or graduate school. Development of coursework and internship plans for senior year.

COM (ANT, HSS) 392 International and Cross-cultural Communications. *3(3 0)S.* Patterns and problems of verbal and nonverbal forms of cross-cultural communication. Avoidance and management of cultural conflict arising from awareness of characteristics and cross-cultural communication. Impact on communication of differing cultural perspectives.

COM 403 Touring Theatre. *Prq: audition required. 3(1 4) S.* A touring performance experience consisting of text analysis, characterization, role development, and performance of scripts.

COM 411 Rhetorical Criticism. *3(3 0) S.* Rhetorical analysis of public speeches, social movements, political campaigns, popular music, advertising, and religious communication. Neo-Aristotelian criticism, movement studies, genre criticism, dramatic analysis, content analysis, fantasy theme analysis.

COM 421 Communication Law. *Prq: Junior standing. 3(3 0) S.* Explores the historical, philosophical, and legal foundations of communication rights and responsibilities. Philosophies and regulations affecting sources, messages, channels, receivers, and situations provide the central focus of the course.

COM 431 Communication in Political Campaigns. *Prq: COM 110. 3(3 0) F. Alt. Yrs.* Roles of analysis and criticism of oral communication in political campaigns; analysis of special political communication situations; ghostwriting, news conferences, negative advertising.

COM 441 Ethical Issues in Communication. *Prq: COM 110, 112, 3(3 0) S.* Critical analysis of ethical problems in interpersonal and public communication practices.

COM 454 Portable Video Practicum. *Prq: COM 354, 3(0-6) S.* Hands-on experience in small video systems production. Students produce instructional videotapes. Provides practical experience in all phases of the production process, including pre-production organization, and critical analysis of the final product.

COM 455 Clinical Practicum in Speech Language Pathologies. *Prq: COM 355, 3(2-2) F, S.* Applies theoretical principles through actual treatment of speech, language, and hearing impaired individuals. Licensed Speech Language Pathologists on staff in the NCSU Speech Clinic supervise treatment provided by students.

COM 456 Organizational Communication. *Prqs: COM 110 or COM 112, or Jr. standing, 3(3 0) F, S, Sum.* Role of human communication in organizations, the assumptions inherent in management philosophies about effective communication, and an investigation of the relationships among communication, job satisfaction, productivity, development, and employee motivation.

COM 462 Cross-Cultural Communication. *Prq: COM 112; 3 additional COM credits, 3(3 0) F.* Communication across cultural boundaries with emphasis on comparative analysis of communication strategies and tactics as well as overall communication systems of various cultures: problems, barriers, patterns of communication.

COM 465 Advanced Clinical Practicum in Speech-Language Pathologies. *Prq: A grade of C or better in COM 455, COM 335, COM 345, 3(2 2) F, S.* Applies theoretical knowledge with practical application for speech, language and hearing impaired individuals. Appraisal and treatment provided by students is under the direct supervision of licensed Speech Language Pathologists on staff in the NCSU Speech Clinic.

COM 474 Video in Business and Industry. *Prq: COM 224 or COM 354, 3(3-0) S.* Planning and controlling the use of video for training, employee communication, public relations, and other purposes in organizations. Applications, organizational variables, and technologies.

COM 496 Communication Internship. *Prq: Jr. standing in Communication; permission of Department. Communication majors only, 3(1-10) F, S.* Directed work of experience for Communication majors with supervision from the work site and the University.

COM 498 Special Topics in Communication. *Prq: Nine hours of communication courses, junior standing and permission of the department, 1-3 F, S.* A detailed investigation of a special topic in the communication arts or sciences.

CROP SCIENCE

CS 200 Introduction to Turfgrass Management. *Prq: BS 100, BO 200, or CS 213, 3(3 0) F.* Turfgrass selection, establishment, maintenance, and pest management in lawn, golf course, athletic field, and roadside care; sod production; and other related industries. Field trips required.

CS 213 Crops: Adaptation & Production. *Prq: BS 100 or BO 200, 4(3-2) F, S.* Fundamental structure and reproductive features of crops. Their adaptation and importance in global agriculture. Practices and inputs needed for economic production of a quality product and interaction of these factors within the constraints of climate, soils, and topography in maintaining a quality environment.

CS 295 Special Topics in Crop Science. *Prq: CS 211, CS 212, or BO 200, 1 6 F, S, Sum.* Individual study of specific crop science principles or production practices. Also present topics of current interest.

DiPAOLA

CS 312 Pastures and Forage Crop. *Prqs: BS 100, SSC 200 recommended, 3(3 0) S.* Production and preservation of the principal forage crops, with attention to the establishment and maintenance of pastures.

CHAMBLEE

CS 318 Corn and Soybean Production. *Preq: CS 211, CS 212, SSC 200. 3(3 0) F., Alt. yrs.* Principles of corn and soybean management in southeastern U. S. A., including cultivar selection, planting, pest management, nutritional requirements, tillage and soil management, water management, harvesting, marketing and utilization.

CS 400 Turf Cultural Systems. *Preq: CS 200, BO 100, SSC 200. 4(3-2) F.* Turf cultural systems related to lawn care operations, golf course management, parks and recreation, athletic field preparation, roadsides and sod production. Emphasis on cultural system development for maximum tolerance to environmental stresses including drought, heat, cold and wear. Field trips required.
DiPAOLA

CS 411 Environmental Aspects of Crop Production. *Preq: BO 421. 2(2 0) F.* The productivity and quality of crops in relation to all environmental factors, including man. Disorders caused by physical and biotic environmental stresses and the role of these environmental factors in normal crop development are emphasized. Utilization and manipulation of the environment for the continued improvement of crops are discussed.
PATTERSON

CS 413 Plant Breeding. *Preq: GN 411. 2(2 0) S.* Discussion of reproductive systems of higher plants; the genetic basis for plant improvement and the selection, evaluation, and utilization of crop varieties.

CS 414 Weed Science. *Preq: CH 220. 4(3 2) F.* History, current status and fundamentals of weed biology and cultural, biological, and chemical weed control; properties and uses of herbicides-weed identification proper use of herbicides and herbicide application equipment; and current weed management practices in crops and non-cropland situations.
WORSHAM

CS 415 Agronomic Pest Management Systems. *Preq: CS 213, CS 200, CS 414. 3(3 0) S.* History, principles, and application of techniques for managing agricultural pests. Theory and practice of integrating pest control tactics to manage pests and minimize environmental impacts. Topics include pest sampling techniques, economic thresholds, biological control, efficient pesticide use, crop pest modeling, animal pest management and IPM economics.
LINKER

CS (SSC) 462 Soil-Crop Management Systems. *Preqs: CS 212, CS 414, SSC 342, SSC 452, senior standing. 3(2-3) S.* (See Soil Science)
FIKE

CS (SSC) 490 Senior Seminar in Crop Science and Soil Science. *Preq: Senior in Agronomy. 1(1 0) S.* Review and discussion of current topics in crop science, soil science, agronomy and natural resource management. Preparation and presentation of scientific information in written and oral format.

CS 492 External Learning Experience. *Preq: Sophomore standing. 1 6 F, S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

CS 493 Special Problems in Crop Science. *Preq: Sophomore standing. 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

CS 495 Special Topics in Crop Science. *1 3 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

CS 511 Tobacco Technology. *Preq: BO 421 or equivalent. 3(3-0) S.*

CS 513 Physiological Aspects of Crop Production. *Preq: BO 421. 3(3-0) S. Alt. yrs.*

CS 591 Special Problems. *Preq: CI. Credits Arranged. F,S,Sum.*

COMPUTER SCIENCE

CSC 100 Computer Literacy. *Credit for CSC 100 is not allowed if student has prior credit in another computer science course or computer related course. Offered only through Independent Studies. 2(2-0).* Survey of electronic data processing, computer hardware and software systems, and developments in information processing. Comprehensive overview of the computer: what it is, what it can and cannot do, how it operates, how it may be instructed to solve problems. Introduces both terminology and applications.

HONEYCUTT

CSC 110 Introduction to Computing Pascal. *Preq: E 115, MA 141. Students taking this course must be eligible to use COE computing equipment. 3(2-3) F.S.* Algorithm development and problem solving in Pascal. Particular elements include: careful and methodical development of Pascal programs from specifications; documentation and style; appropriate use of control structures, data types and subprograms; abstraction and verification; numeric and nonnumeric applications.

CSC 112 Introduction to Computing FORTRAN. *Preq: E 115, MA 141. Students taking this course must be eligible to use COE computing equipment. 3(2-3) F.S.* Problem solving through writing FORTRAN programs. Particular elements include: careful development of FORTRAN programs from specifications; documentation and style; appropriate use of control structures, data types and subprograms; abstractions and verification; engineering applications.

CSC 200 Introduction to Computers and Their Uses. *May not be used by CSC major as a restricted elective. 3(2-2) F,S,Sum.* Computer history, hardware, systems analysis, security and legal issues. Software, including desirable characteristics of programs, the programming process, writing programs, and using a spreadsheet program.

CSC 201 Basic Computer Organization and Assembly Language. *Preq: CSC 210. 3(3-0) F,S,Sum.* History of computing. Number systems, von Neuman machines, instruction sets and machine code, data representation, assemblers and assembly language programming, compilers, external and internal processor organization, memory, I/O organization and devices, and simple multi-processors. Detailed study of a contemporary processor.

CSC 202 Concepts and Facilities of Operating Systems. *Preq: Assembler Language. 3(3-0) F,S.* History and development of operating systems. Primary components and services of contemporary multi processing systems; file systems, memory and process management, scheduling policies, virtual resources, terminal interface, command languages, linking and loading, program execution, event-driven kernel, device drivers, system performance, concurrency control, distributed systems. Detailed study and use of a contemporary system.

CSC 210 Concepts of Programming Languages. *Preq: CSC 110. 3(3-0) F,S,Sum.* Advanced features of general purpose high-level programming languages: dynamic data structures, recursion, modularity for large programs. Structure, interpretation and translation of languages. Structured programming, programming environments, language dependent and independent methodology. Survey of languages and a case study of a problem oriented language.

CSC (MA) 222 Applied Discrete Mathematics. *Preq: CSC 110, MA 141. 3(3-0) F,S.* Formal logic. Methods of proof including induction. Introduction to grammars and finite state machines. Recurrence relations and asymptotic behavior of functions. Sets and counting. Boolean expressions and logic networks. Graphs and relations.

CSC 252 Principles of Programming—COBOL. *Preq: CSC 110. 2(2 0) F,S,Sum.* Introduction to the business oriented programming language COBOL. Programming assignments cover general data processing, file maintenance and report generation.

CSC 254 Principles of Programming APL. *Preq: MA 405. 1(1-0).* Advanced programming concepts in APL and their application to a wide variety of computing problems. The APL reference language and locally available APL hardware representations.

CSC 255 Principles of Programming—SNOBOL. *1(1 0).* Syntax and semantics of the symbol manipulation language SNOBOL 4. Application of the language to programming problems in non-numeric areas.

CSC 258 Programming Language-C. *Preq: CSC 202. 2(2-0) F,S,Sum.* Systems implementation language C. History and current applications; syntax and semantics of C; paradigms of C that set it apart from other high level languages; C programming environment.

CSC 295 Special Topics in Computer Science. *1-3.* Special topics in CSC at the early undergraduate level.

CSC 302 Introduction to Numerical Methods. *Preqs: CSC 110 or CSC 112, MA 242. 3(3-0) F,S.* Numerical computations with digital computers; floating point arithmetic and implications of round-off error. Algorithms and computer techniques for the numerical solution of problems in: function evaluation; zeros of functions; interpolation; numerical differentiation and integration; linear systems of equations; curve fitting; solutions of non-linear equations; numerical solutions of ordinary differential equations.

CSC 310 Software Engineering. *Preq: CSC 202 and CSC 311. 3(3 0) F,S.* Application of product engineering methods to software: quality assurance, project management, requirements analysis, specifications, design, development, testing, production and maintenance.

CSC 311 Data Structures. *Preq: CSC 210, 222. 3(3 0) F,S,Sum.* A survey of fundamental abstract data types along with efficient implementations for each. Emphasizes asymptotic running time as a measure of program performance. Lists, stacks, queues, sparse arrays, binary trees, heaps, balanced search trees, and hash tables. Illustrative applications such as graph, text-processing, or geometric algorithms.

CSC 312 Computer Organization and Logic. *Preqs: CSC 201, CSC 222. 4(3 3) F,S.* Combinational logic circuits and their relation to Boolean algebra. Functional properties of combinational and sequential components and their realizations in integrated circuit forms. Organization of digital computer components; processors, control units, memories, switches, and peripherals. Architecture of computer systems. Computer arithmetic. Microprogrammed control. Interrupt mechanisms. Laboratory exercises involve logical, functional, and electrical properties of components from gates to microprocessors.

CSC 333 Automata, Grammars, and Computability. *Preq: CSC 222. 3(3-0) F,S.* Study of three classical formal models of computation: finite state machines, context-free grammars, and Turing machines and the corresponding families of formal languages. Power and limitations of each model. Parsing. Non-determinism. The Halting Problem and undecidability. The classes P and NP, and NP-completeness.

CSC 379 Ethical Implications of Computing. *Preq: Junior standing. 1(1 0) S.* Discussion of the concern for the way in which computers pose new ethical questions or pose new versions of standard moral problems and dilemmas. Study of ethical concepts to guide the computer professional. Computer professional codes of ethics. Use of case studies to relate to ethical theory. Ethical and legal use of software. Conflicts of interest.

CSC 401 Data and Computer Communications Networks. *Preq: MA 314 or ST 371, CSC 202. Credits are not allowed for both CSC 401 and ECE 410. 3(3-0) F.* Basic concepts of data communication networking and computer communications architectures, including packet switching, local area networks, OSI (Open System Interconnection Architectures), TCP/IP, X.25, X.75, and SNA (System Network Architecture).

- CSC (MA) 416 Introduction to Combinatorics.** *Preqs: MA 242 and proficiency in a programming language. 3(3 0). S Alt. Yrs.* (See Mathematics for description.)
- CSC 417 Theory of Programming Languages.** *Preq: CSC 311. 3(3-0) F,S.* Theory of design and implementation of programming languages. Topics include the definition, translation, and structure of programming languages. Formal languages and automata are introduced and their applications to language definition and translation are presented. The design and implementation of language features discussed and existing programming languages compared.
- CSC 421 Introduction to Management Information Systems.** *Preq: Jr. standing in CSC or LEB. 3(3 0) F,S,Sum.* Principles and techniques of information analysis and systems design as they relate to the development of management information systems (MIS). Information flow. Information requirements of management. Decision-making models. Operations analysis and modelling techniques. Organizational behavior. Systems design process. Systems analysis tools. Management games.
- CSC 422 Management Information Systems Projects.** *Preq: CSC 421. 3(3 0) F,S.* Development of computer based management information systems. Decision systems. Decision support systems. Interface considerations between management and the information systems. Data base concepts. Planning and programming management information systems. Cost-effectiveness and cost benefits analysis. Management information systems project.
- CSC 423 Information Resources Management.** *Preq: CSC 421. 3(3 0) S.* Information Resources Management as a process that encompasses strategic planning, the implementation of new technology, dramatic changes to both the corporate Management Information Services and traditional information systems architecture, and the emerging role of end user computing to enable a business enterprise to operate effectively.
- CSC (MA) 427 Introduction to Numerical Analysis I.** *Preqs: MA 301 and programming language proficiency. 3(3-0) F.* Theory and practice of computational procedures using a digital computer, including approximation of functions by interpolating polynomials, numerical differentiation and integration, and solution of ordinary differential equations including both initial value and boundary value problems. Computer applications and techniques.
- CSC (MA) 428 Introduction to Numerical Analysis II.** *Preqs: MA 405 and programming language proficiency; MA (CSC) 427 is not a prerequisite. 3(3 0) S.* Computational procedures using digital computers. Solution of linear and nonlinear equation, matrices and eigenvalue calculations; curve fitting and function approximation by least squares, smoothing functions, and minimax approximations.
- CSC 431 File Organization and Processing.** *Preq: CSC 311. 3(3-0) F,S.* Hardware characteristics of storage devices. Basic file organizations including sequential, direct, and indexed sequential; hashing and collision resolution; perfect hashing; signatures; bloom filters; sorting and other bit level structures. Tree structures including binary search trees, B trees, and tries. Dynamic hashing techniques. Structures including grid files. Applying file structures to practical problems.
- CSC 432 Database Management Systems.** *Preq: CSC 431. 3(3-0) F.* Introduction to database concepts. Data models: hierarchical, network and relational. Query languages. Query optimization. Database design. Implementation considerations. Concurrency and locking. Data integrity. Distributed databases. Database machines. Use of a commercial database system. A course project assigned.
- CSC (IE) 441 Introduction to Simulation.** *Preqs: MA 242, ST 372, programming proficiency. 3(3-0) F, S.* Discrete-event stochastic simulation for the modeling and analysis of systems. Programming of simulation models in a simulation language. Input data analysis, variance reduction techniques, validation and verification, and analysis of simulation output. Random number generators and random variate generation.

CSC 451 Operating Systems. *Preq: CSC 202, CSC 311. 3(3-0) F.S.* Functions, structure, history and development of assemblers, macroprocessors, loaders, linkers, editors, interrupt handlers, device drivers, and other operating system components. Processor architecture, input output devices from a software point of view. High level language constructs supporting concurrency in programming. Programming required.

CSC 452 Operating Systems Projects. *Preq: CSC 451. Coreq: ENG 321. This course qualifies as project course required of CSC majors. 3(3-0) F.S.* Definition, design, and implementation of a significant operating system project from such areas as single or multi-user file systems, process management, virtual memory, time-sharing, real-time control. Programming required.

CSC (ECE) 460 Digital Systems Interfacing. *Preq: A grade of C or better in either ECE 218 or CSC 312. 3(2-3) F.S.* Concepts of microcomputer system architecture and applications to fundamental computer hardware. Theoretical and practical aspects of interfacing and a variety of microprocessor peripheral chips with specific microprocessor microcomputer systems from both hardware and software points of view.

CSC 461 Computer Graphics. *Preqs: MA 242 or MA 212; CSC 110 or CSC 112. 3(3-0) F.* Principles of computer graphics with emphasis on two dimensional raster graphics. Topics include: graphics hardware and software, line and polygon drawing algorithms, transformations, segments, windowing and clipping, and interaction techniques. Core Graphics Standard followed for algorithm implementation. Programming required.

CSC 462 Computer Graphics Projects. *Preq: CSC 461; Coreq: MA 305. This course qualifies as project course required of CSC majors. 3(3-0) S.* Principles of computer graphics with emphasis on three-dimensional raster graphics. Topics include: transformations projections, windowing and clipping, hidden lines and surfaces, shading, and curved surface representation. Core Graphics Standard followed for algorithm implementation. Programming required.

CSC 471 Programming Environments. *Preqs: CSC 202, CSC 311. 3(3-0) F.* Software systems for intensive programming. Support tools, prototyping, instrumentation, layering, subsystem organization, programmer coordination, documentation and configuration control will be illustrated on UNIX, which will be examined in detail: C language, libraries, system calls, file system, the Shell, and major utilities. Comparative survey of other contemporary environments.

CSC 472 Software Engineering Project. *Preq: CSC 471. Coreq: ENG 321. Audits not allowed. 3(3-0) S.* Development of a complex application subsystem following software engineering methods: requirements analysis, design, documentation quality assurance, configuration control, work and time management. Introduce distinction of development and target environments. Term project required. Additional topics dependent upon application.

CSC 481 Software Engineering with Ada. *Preq: CSC 311. 3(3-0).* Theory and practice in the high order language Ada, with emphasis on software engineering issues addressed by the language. Language applications and techniques.

CSC 495 Special Topics in Computer Science. *Preq: CI. 1 6 F,S,Sum.* Used for the following types of study: readings in the literature of computer science, introductory research projects, major computer programming projects, seminars, or new course development. Work may be done in any CSC area such as software, hardware utilization, programming languages, numerical methods or telecommunications.

CSC 499 Independent Research in Computer Science. *Preq: Consent of Department. 1 6 F,S,Sum.* Independent investigation of a research problem under faculty supervision.

Selected 500-Level Courses Open To Advanced Undergraduates

CSC (ECE) 501 Operating System Principles. *Preqs: CSC 201, CSC 311 and MA 421. 3(3-0) F.S.*

- CSC (ECE) 506 **Digital Systems Architecture.** *Preq: CSC 312. 3(3-0) F.S.*
- CSC (ECE) 510 **Software Engineering.** *Preqs: CSC 311 and CSC 222. 3(3-0) F.*
- CSC 511 **Artificial Intelligence I.** *Preq: CSC 311. 3(3-0) F.S.*
- CSC (ECE) 512 **Compiler Construction.** *Preq: CSC 311. 3(3-0) S.*
- CSC 541 **Advanced Data Structures.** *Preq: CSC 311. 3(3-0) F.*
- CSC (ECE) 542 **Database Management.** *Preq: CSC 431 or CSC (ECE) 501. 3(3-0) F.*
- CSC (ECE) 571 **Data Transmission Communications.** *Preqs: CSC 312 or ECE 301. 3(3-0) S.*
- CSC (ECE) 572 **Computer Communications.** *Preq: CSC 312. Coreq: B average in technical subjects. 3(3-0) F.*
- CSC (ECE) 573 **Introduction to Computer Performance Modelling.** *Preq: MA 421. Coreq: CSC 501. 3(3-0) F.*
- CSC (ECE) 574 **Real Time Computer Systems.** *Preq: CSC 405 or CSC (ECE) 501. 3(3-0) Alt. S.*
- CSC (MA) 583 **Numerical Solution of Ordinary Differential Equations.** *Preq: MA 512. 3(3-0) S.*
- CSC (MA) 584 **Numerical Solution of Partial Differential Equations Finite Difference Methods.** *Preq: Knowledge to the level of CSC 427 428. 3(3-0) F.S.*
- CSC (MA, OR) 585 **Graph Theory.** *Preq: MA 405. 3(3-0) F.*

DANCE

DAN 272 **Dance Composition.** *Preq: PE 274 or PE 264. 1(0-2) F.S.* Creative problem-solving using the components of movement composition. Development of movement vocabulary through structured improvisation. Development of a thematic phrase through various choreographic devices. Structure of the developed materials.

DAN 295 **Problems of Dance Performance.** *Preq: audition. 2(0-4) F.S.* Practical performing experience in a company setting. Rehearsal, performance and production of concert dance.

DESIGN FUNDAMENTALS

(Also see DN Design)

DF 101 **Design Fundamentals Studio I.** *School of Design students only or written approval of department head and dean. 6(0-11) F.* Introduction to the design disciplines and departments of the School of Design. A studio course examining the techniques and attitudes for dealing with identification, solution and evaluation of problems arising from the design of physical artifacts in the natural and built environment. The design studio process includes the acquisition of languages and skills appropriate to design studies.

DF 102 **Design Fundamentals Studio II.** *Preq: DF 101 or written approval of department head and dean. 6(0-9) S.* Second course-design disciplines and departments of the School of Design. Examines the techniques and attitudes for dealing with identification, solution, and evaluation of problems arising from the design of physical artifacts in natural and built environments. Acquisition of languages and skills appropriate to design studies.

DF 111 **Two Dimensional Design for Non-Design Majors.** *This course is not open to School of Design students. 3(0-6) F.S.* An introduction to the fundamentals of design studies through two dimensional problems. The basic elements and concepts of design will be explored as abstract and applied problems through design issues. It is the goal of this course to provide non design students an introduction to design principles and a language of design.

DF 112 Three Dimensional Design for Non-Design Majors. *This course is not open to School of Design students. 3(0-6) F.S.* An introduction to the fundamentals of design studies through three dimensional problems. The basic elements and concepts of design will be explored as abstract and applied problems through the design issue. It is the goal of this course to provide non design students a working knowledge of design principles and a language of design.

DESIGN

(Also see ARC—Architecture, DF Design Fundamentals, GD Graphic Design, ID Industrial Design, and LAR Landscape Architecture.)

DN 212 Basic Photography. *Preq: DF 102. 3(2-2) F.S.* Introduction to the processes and visual skills necessary for the beginning photographer. Darkroom experimentation, pin-hole camera, basic rudiments of camera use, film development and printing. Exploration of issues related to the quality of visual communication.

DN (TAM) 272 Printed Textile Design. *A grade of C or better in DF 101 or DF 111. 3(3 0) F.S.* Design and production of printed and pattern dyed fabrics. Development of design abilities through hand production methods with an awareness of industrial processes. WILCHINS

DN 273 Materials and Processes in Fibers and Surface Design. *Preq: DF 101 or DF 111 or DF 112. 3(0-6) F.S.* Introduction to historical and contemporary hand processes used by the textile designer. Students will learn a variety of textile techniques utilizing traditional and experimental methods. Emphasis on technical exploration and development.

DN 292 Special Topics in Design. *Preq: Consent of instructor. 1-3. F.S.* Topics of current interest in the School of Design.

DN 311 Basic Visual Laboratories. *Preq: Design Majors: DF 102; Non Design Majors: DF 111, 112. 3(0-6) F.S.* Basic activities that relate to the major design areas in the School of Design. Study of visual communication skills in areas of illustration, printmaking, and life drawing. The student elects instructor and area(s) of activity.

DN 312 Intermediate Photography. *Preq: DN 212. 3(2 2) F.S.* Continuation on an advanced level of the skills and techniques developed in Basic Photography. Purpose is to develop use of camera as a perceptual tool to increase awareness and sensitivity of visual imagery.

DN 316 Film Animation. *Preqs: DF 102; or DF 111 and 112. 3(3-0) Alt. yrs. S.* A course in experimental film animation with emphasis on the integration of drawing, sculpture, 3-dimensional model building and film making.

DN 354 Building Workshop. *Preq: DF 102. 3(2-2) S.* Gives the student the opportunity to concentrate on the process and logic of building one's own design. The workshop brings together structural behavior, geometry, and materials in the construction of physical form at a large scale. The experience of execution offers the opportunity for evaluative testing with the critical support of a faculty member. TAYLOR

DN 381 Basic Drawing. *Preq: DF 102; or both DF 111 and DF 112. 3(0 6) F.* A beginning descriptive drawing experience which teaches students to see, analyze, and transcribe observed subject matters. The transcription incorporates formal drawing issues (line, form, texture) with traditional and contemporary material space exploration.

DN 384 Basic Painting. *Preq: DF 102; or both DF 111 and DF 112. 3(0-6) F.* Introduction to the principles of painting through class projects that expose students to different painting materials and techniques. Students learn to build a stretcher, size and prime a canvas as well as other rigid painting surfaces. Acrylic and oil paint used; projects assigned and open themes. DIAZ

DN 386 Basic Sculpture. *Preq: DF 101 and DF 112. 3(0 6) F.* Studio course introducing basic concepts, materials, and processes of sculpture. Instruction incorporates both traditional and contemporary form generation with emphasis on developing formal perceptions and projection. RAYMOND

DN 400 Design Studio. *Preq: DF 102 or written approval of department head and dean. Course may be used to partially satisfy studio requirement in all undergraduate degree programs in the School of Design. 6(0 9) F.S.* Studio offering upper level undergraduates the opportunity to intensively study general design issues (form, color, structure, proportions, scale, etc.) in a studio mode. PAUSE, TAYLOR

DN 411 Advanced Visual Laboratory. *Preq: DF 102; or both DF 111 and DF 112. May be taken for a minimum of 12 credit hours by School of Design students. 3(0-6) S.* Visual communication skills in the areas of sculpture, life drawing, painting, illustration, and printmaking. JOYNER

DN 412 Advanced Photography. *Preq: DN 312. 3(2 2) S.* Use of the camera as a communicative vehicle for the expression of ideas and information. The study and manifestation of visual imagery.

DN 413 Synthetic Drawing. *Preq: DF 102 or DF 111; DF 112. 3(2-3) Every 3rd Sem.* Orthographic and axonometric projections, coordinating and perspective systems, and diagramming to facilitate the drawing of shapes and forms conceived by the designer in order to make visually precise simulations of design ideas. TAYLOR

DN 414 Color and Light. *Preq: DF 102. 3(3 0) F.S.* Physical and perceptual nature of color, color awareness, sensitivity and skills in visual communication with color as a designer's tool. PAUSE

DN 454 Geometry for Designers. *Preq: Junior standing. 3(3 0) F.* Geometry and its application to the various fields of design. Mathematical and drawing skills required. TAYLOR

DN 455 Building Workshop. *Preq: DF 102 or both DF 111 and DF 112. 3(2-2) Every 3rd Sem.* Process and logic of producing one's own design. Structural behavior, geometry, and materials in the construction of physical form usually at a large scale. Evaluative testing with critical support.

DN (TAM) 470 Textile Design Studio. *Preqs: A grade of C or better in DN(TAM) 272, 371, and 372. 6(0 9) F.* Semester design project based on a single problem statement. Individual investigation of resources, processes, and solutions in the development of a collection of fabrics or end products. Public exhibition of collections.

DN 472 Advanced Surface Design. *Preq: DF 101, DN 272. 3(0-6) F.S.* Advanced problems in the design and production of hand-printed and pattern-dyed fabrics. Experimentation with advanced color application techniques. Exploration of pattern and image production on fabric and development of design abilities in textile media. Specific focus changes each semester.

DN 480 Intermediate Studio. *Preq: DF 101 and DF 102; or DF 111, DF 112 and DN 311F. 6(0-9) F.S.* Studio format offering upper level undergraduates the opportunity to intensively study general design issues (form, color, structure, proportions, scale, etc.) through individual study in drawing, painting, sculpture, photography, or printmaking.

DN 481 Intermediate Drawing. *Preq: DN 381. 3(0 6) S.* An intermediate-level drawing course that further develops the designer's graphic, analytic, observational, and conceptual skills.

DN 484 Intermediate Painting. *Preq: DF 102; or both DF 111 and DF 112. 3(0-6) S.* An intermediate level painting course that through slide lectures, class projects, and assigned readings exposes students to contemporary painting art movements. Special emphasis given to the formal and interpretative analysis of a painting. Acrylic and oil paint used; projects have assigned and open themes. DIAZ

- DN 486 Intermediate Sculpture.** *Preq: DN 386. 3(0 6) S.* An intermediate-level sculpture course that further develops the designer's analytic, observational, and conceptual skills. RAYMOND
- DN 487 Sculpture: Life Modeling.** *Preq: DF 101 or DN 411S. 3(0 6) S.* A studio course with direct observation of nature a primary concern. In-depth study of specific modeling concepts and processes. RAYMOND
- DN 491 Special Seminar in Design. 1 3 F,S.** Seminars on subjects of current interest in design.
- DN 492 Special Topics in Design. 1-3 F,S.** Topics of current interest in the School of Design normally used to develop new courses.
- DN 494 Internship in Design.** *Preq: Junior standing in Design; 3.0 GPA or better; and approval of department head. 3 6 F,S.* Supervised field experience in design offices and organizations. TAYLOR
- DN 495 Independent Study in Design.** *Preq: Junior standing in Design; 3.0 GPA or better; and approval of department head. 1-3 F,S.* Special projects in design developed under the direction of a faculty member on a tutorial basis. TAYLOR

ENGINEERING

- E 100 Introduction to College of Engineering.** *0(1 0) F.* Orientation to the University and introduction to the College of Engineering and the engineering profession. General academic requirements and special educational opportunities, the history of engineering and computer science, professionalism and ethics.
- E 110-111 Engineering Scholars Forum.** *Preq: Enrollment limited to participants in the Engineering Scholars Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.
- E 115 Introduction to Computing Environments.** *1(0 2) F,S,Sum.* Fundamentals of the EOS System. Software and services available on the system. Network hardware configuration, on line help and communication, file and directory manipulation. Software applications such as e mail, publishing packages, spreadsheets, mathematical packages, CAD packages.
- E 210-211 Engineering Scholars Forum.** *Preq: Enrollment limited to participants in the Engineering Scholars Program. 0(2-0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.
- E 432 Patents, Trademarks and Copyrights.** *Preq: Jr. standing. 3(3-0) S.* Patent, trademark and copyright problems that arise in engineering, scientific and industrial pursuits. Includes the rights and remedies available to individual inventors and authors as well as companies. Patent Office procedures and practices. MILLS
- E 497 Engineering Research Projects.** *Preq: Jr. standing in College of Engineering; Restricted to participants in Engineering Scholars Program and Engineering Research Center Scholars. 1 3 F,S,Sum.* Projects in research, design or development in engineering or computer science.

Selected 500-Level Courses Open To Advanced Undergraduates

- E (MA, OR) 531 Dynamical Systems and Multivariable Control.** *Preqs: MA 301, 405 or equivalent. 3(3-0) F.*

ADULT AND COMMUNITY COLLEGE EDUCATION

EAC 478 Extension as Non-Formal Education. *Prereq: Advanced undergraduate or PBS. 3(3-0) S.* Extension as a system of non-formal education, how it functions in USA and other countries (with special attention to agricultural extension), historical antecedents and philosophical foundations, mission, organization, methods; problems dealt with; how technology and behavioral sciences are can be utilized; provides actual experience with Extension and with conceptual theoretical ideas that undergird practice. Day field trips.

ECONOMICS

EC 201 Introduction to Economics I. *Credit will not be awarded for both EC 201 and ARE 212. Students interested in agriculture and natural resources should enroll in ARE 212 instead of this course. 3(3-0) F,S,Sum.* Scarcity, production possibilities, and opportunity cost. Supply and demand analysis, free markets, the price system, and government policy. Microeconomic analysis of business decisions in competitive and noncompetitive markets. Macroeconomic analysis of production, employment, the price level, inflation, and economic growth. Monetary policy, fiscal policy, and stabilization of the economy. Comparative advantage and international trade. HYMAN

EC 202 Economic Problems and Issues. *Prereq: EC 201 or ARE 212. 3(3-0) F,S,Sum.* The marketplace and government as alternative means of allocating resources. Environmental pollution and government regulation of markets. Application of economics to current social issues. Analysis of labor markets and wages. Interest rates and investment. Issues in stabilization policy. Foreign exchange rates, the balance of international trade, and the role of the U.S. in the modern global economy.

EC (ARE) 301 Intermediate Microeconomics. *Prereqs: MA 113 or 112; EC 201 or 212. Credit not allowed for both EC(ARE) 301 and 401. 3(3-0) F,S,Sum.* Functioning of the market economy; role of prices in determining the allocation of resources; the functioning of the firm in the economy; forces governing the production of economic goods.

EC 302 Intermediate Macroeconomics. *Prereqs: EC 201 or ARE 212; MA 113 or MA 112. 3(3-0) F,S,Sum.* Relates the economic behavior of households, business firms, the central bank, and government to the determination of the levels of national income, employment, inflation, and growth in production capacity. Problems of public policy making in the pursuit of macroeconomic goals such as high employment, price stability, and adequate growth in the economy's production capacity.

EC (BUS) 310 Managerial Economics. *Prereq: EC 201 or ARE 212. 3(3-0) F,S.* Economic principles applied to decision making in the firm. The relationship between accounting and economic concepts of cost. Pricing for sales within and outside the firm. The consequences for the firm of the competitive economy. The meaning of risk. Decision-making under uncertainty. The implications of transactions costs for the organization of firms.

EC (ARE) 336 Introduction to Resource and Environmental Economics. *Prereq: ARE 212 or EC 201. 3(3-0) S.* Application of basic economic tools to understand and evaluate environmental resource policies. Concepts such as property rights, non-market goods, allocation over time, externalities, and public goods. Current policy issues such as global climate change, evaluating natural resource damages from oil spills, reducing the costs of regulations, protecting estuaries, and dealing with non-point source pollution. CARLSON, PALMQUIST, SMITH

EC 370 The Rise of Industrialism. *Prereq: EC 201 or 212. 3(3-0) F,S.* Historical development of the modern industrial economy from origins in medieval and early modern Europe. The industrial revolution in England and its diffusion throughout the western world and beyond. D. FISHER

EC 371 Evolution of the American Economy. *Prereq: EC 201 or 212. 3(3-0) F,S.* Relationship of modern economic development to the history of America. Analysis of contemporary problems and issues with reference to their origins in the historical growth of the economy. BALL, CRAIG

EC (ARE) 401 Economic Analysis for Nonmajors. *Preq: EC 201 or 212. Not open to undergraduates majoring in the College of Management or Department of Agriculture and Resource Economics. Credit not allowed for both EC(ARE) 301 and EC(ARE) 401. 3(3-0) F.S.* Intermediate economic theory of firm, household, market behavior. Demand, production and cost theory, market equilibrium under competitive and noncompetitive conditions; problems of economic efficiency. Primarily for graduate students desiring an economics minor at the master's level. Students completing intermediate microeconomics and calculus should elect ECG 501, Price Theory, instead.

EC (BUS) 404 Money, Financial Markets, and the Economy. *Preq: EC 302. 3(3 0) F.S., Sum.* Roles of money, credit, and financial institutions in a market economy. Allocation of credit, the determination of interest rates and security prices, and the activities of the Federal Reserve System. Pricing models. FISHER, LAPP, PEARCE

EC 410 Public Finance. *Preq: EC(ARE) 301. 3(3 0) F.S.* A microeconomic analysis of the rationale for public expenditure and taxation. Externalities, pollution and public policy, income redistribution and public welfare, public goods, collective choice and political institutions, public budgeting techniques and cost-benefit analysis, taxation and tax policy, state local finance and fiscal federalism. HYMAN, KNOEBER

EC 413 Competition, Monopoly and Public Policy. *Preq: EC(ARE) 301. 3(3-0) S.* Current theories of industrial organization with specific reference to such topics as cartels, industrial concentration, vertical integration, franchise contracts, ownership and control of firms, multipart and discriminatory pricing, and tie in sales. Economic aspects of antitrust law and government regulation of industry. ERICKSON, FLATH, MARGOLIS, NEWMARK

EC 431 Labor Economics. *Preq: EC(ARE) 301. 3(3 0) F.S.* An economic approach to the labor market and its problems including unemployment and the determination of wages, hours and working conditions under various labor market structures. The economic effects of trade unions. Introduction to human capital theory. ALLEN, CLARK, FEARN, WESSELS

EC 435 Urban Economics. *Preq: EC (ARE) 301. 3(3 0).* Application of land use and location theory to urban structure and centralized economic activity. Analysis of trends in urbanization and suburbanization. Urban poverty, housing, transportation, pollution and financial problems. MARGOLIS, PALMQUIST

EC 436 Environmental Economics. *Preq: EC(ARE) 301. 3(3-0) F.S.* Use of economics in understanding pollution, congestion, conservation and other environmental problems. Relevant economic tools such as pricing schemes, abatement cost curves, damage functions and benefit cost analysis. Pollution taxes, regulations and subsidies considered in designing alterations in the incentive system. Public policy alternatives examined in the context of non-market decision making. CARLSON, PALMQUIST, SMITH

EC 437 Health Economics. *Preq: EC (ARE) 301 or EC 401. 3(3 0) F.S.* Applications of microeconomics tools to analysis of public and private policy issues concerning health care financing and delivery in the United States. HEADEN

EC 442 Evolution of Economic Ideas. *Preq: EC 201 or 212. 3(3 0) F.S.* General development of economic ideas from ancient times through Keynes. Emphasis on the classical school and developments thereafter. The evolution of economic ideas in the context of the changes in technology and the increasing complexity of economic activity. TURNER

EC 448 International Trade. *Preq: EC(ARE) 301. 3(3 0) F.S.* Determinants of commodity composition of trade and analysis of tariffs, quotas, transport costs. Treatment of international investment, multinational corporations. Effects of tariffs and quotas. Relationship between international trade and economic growth. BALL, DUTTON, GRENNES

EC (BUS) 449 International Finance. *Preq: EC 301. 3(3 0) F.S.* International markets and their effects on firms, investors and national economies. Futures and options in foreign exchange, management of foreign exchange risk, exchange rate determination, and macroeconomic policy in an open economy. GRENNES

EC 451 Introduction to Econometrics. *Preqs: EC (ARE) 301, EC 302, BUS (ST) 350, 3(3 0) F.* The measurement, specification, estimation and interpretation of functional relationships through single equation least square techniques. Applications of simple and multiple regression, curvilinear regression and various transformations to demand, cost, production, consumption and investment relationships. HALL, SMITH

EC 470 The Japanese Economy. *Preqs: EC (ARE) 301; 3 hours HI. 3(3 0) S.* The Japanese economy from an ancient agrarian economy to a modern industrial nation. Comparative analysis of post World War II Japanese macroeconomic growth, money and banking, public finance, labor markets, industrial organization, and international trade and finance. FLATH

EC 475 Comparative Economic Systems. *Preq: EC 201 or 212. 3(3-0) F,S.* Review of capitalist and market economies. Comparison with collectivist economic systems, in particular the Soviet economy. TURNER

EC 490 Honors Research Seminar in Economics. *Preq: GPA 3.0 plus two EC honors courses. 3(3 0) F.* Final course for students completing the undergraduate honors program in economics. Classroom presentations related to the general topic of the seminar and research papers.

EC 495 Special Topics in Economics. *Preq: Consent of Department. 1-6.* Presentation of material not normally available in regular course offerings, or offering of new courses on a trial basis.

EC 498 Independent Study in Economics. *Preq: Consent of Department. 1 6. F,S,Sum.* Detailed investigation of topics of particular interest to advanced undergraduates under faculty direction on a tutorial basis. Credits and content determined by faculty member in consultation with Associate Department Head.

Selected 500-Level EC Courses Open To Advanced Undergraduates

ECG 501 Price Theory. *Preqs: MA 113 and EC (ARE) 301. 3(3-0) F,S.*

ECG 502 Income and Employment Theory. *Preqs: MA 113. EC (ARE) 301, 302 and EB (ST) 350. 3(3 0) F,S.*

ECG 512 Law and Economics. *Preq: EC (ARE) 301 or EC (ARE) 401. 3(3 0) Alt. F.*

ECG 515 Environmental and Resource Policy. *Prq: EC (ARE) 301 or EC (ARE) 401. 3(3 0) Alt. F.*

ECG 521 Markets and Trade. *Preq: EC (ARE) 301 or 401. 3(3-0) F.*

ECG 523 Planning Farm and Area Adjustments. *Preqs: EC (ARE) 301, 303 or 401. 3(2 2) S.*

ECG 532 Economics of Trade Unions. *Preq: EC (ARE) 301 or 401. 3(3 0).*

ECG 533 Economics of World Food and Agricultural Policy. *Preq: EC (ARE) 301 or 401. 3(3 0) S.*

ECG 540 Economic Development. *Preq: EC (ARE) 301 or 401. 3(3 0).*

ECG 551 Agricultural Production Economics. *Preqs: MA 113 and EC (ARE) 301 or EC (ARE) 401. 3(3-0) S.*

ECG 570 Analysis of American Economic History. *Preq: EC 371 or graduate standing or PBS status. 3(3 0) F,Alt,Yr.*

COUNSELOR EDUCATION

ECD 101 University Orientation I. *Open to University Transition Program (UTP) students only. 1(1-0) F.* An orientation to academic requirements of the various colleges and departments at the University, a review of study skills and time management, advising procedures and decision-making skills, designed to assist students to develop a knowledge of major requirements and requisite comprehension and skills to succeed in college.

ECD 102 University Orientation II. *Open to University Transition Program (UTP) students only. 1(1-0) S.* A continuation of ECD 101, the course emphasizes the further development of study skills, time management and methods for the selection of a major field of study.

ECD 220 College Student Development and Peer Counseling. *Preq: Sophomore standing. Priority will be given to resident advisors and students active in student organizations or volunteer programs. 2(2-0) F,S.* Developmental issues of young adulthood with opportunity for the acquisition of paraprofessional counseling skills and crisis intervention skills. Major consideration is given to self-awareness and values clarification through utilization of personality inventories and self-assessment instruments.

ECD 221 Career Planning and Personal Development. *3(3-0) F,S.* Knowledge, attitudes, self-understanding, and skills needed to enhance career planning and foster personal development. Study of self-understanding, self talk, goal setting, the environment, and decision making as ways to adapt more effectively to the challenges of life.

ECD 400 Value Development. *Preq: Junior standing. 2(2-0) S.* Kohlberg's theory of the development of moral judgment applied to value dilemmas commonly confronted by young adults and adults in general. Structured and unstructured identification of stages of moral reasoning. Independent formulation of value dilemma issues. Basic small group communication skills for synthesis of value dilemma issues and their analysis.

ELECTRICAL AND COMPUTER ENGINEERING

ECE 211 Electric Circuits I. *Preqs: Soph. standing and GPA 2.4 or above, with a grade of C or better in ENG 111, MA 141, MA 241, and PY 205. Coreqs: PY 208, MA 242. Independent Studies version may be taken only with approval of ECE Undergraduate Administrator. 3(3-0) F,S,Sum.* Introduction to theory, analysis and design of electric circuits. Circuit parameters and elements: voltage, current, power, energy, resistance, capacitance, inductance. Kirchhoff's laws and circuit-analysis techniques. Linearity, superposition, Thevenin's theorem. Active circuit elements and elementary amplifiers. Transient response of energy-storage circuits. Periodic functions, RMS values, phasors. Sinusoidal steady-state response, resonance, Q, bandwidth. Introduction to frequency response.

ECE 212 Fundamentals of Logic Design. *Preq: Soph. standing and GPA 2.4 or above, with a grade of C or better in ENG 111, MA 141, MA 241 and PY 205. 3(3-0) F,S,Sum.* Introduction to digital logic design: Boolean algebra, switching functions, Karnaugh maps, modular combinational logic, flip-flops, latches, synchronous sequential circuits, case studies in asynchronous digital design.

ECE 213 Electric Circuits I Laboratory. *Preq: ECE 211 (independent study students); Coreq: ECE 211. 1(0-3) F,S,Sum.* Laboratory work on material treated in ECE 211 emphasizing elementary design principles.

ECE 214 Fundamentals of Logic Design Laboratory. *Coreq: ECE 212. 1(0-3) F,S,Sum.* Laboratory on material treated in ECE 212 emphasizing elementary design principles.

ECE 218 Computer Organization and Microprocessors. *Preq: CSC 101 and a grade of C or better in ECE 212. 3(2-3) F,S.* Digital computer organization. Assembly language programming. Input/output. Interrupts and traps. Direct memory access. Structured program development. Comparison of microprocessor architectures. Detailed study of Motorola 68000.

ECE 221 Electric Circuits II. *Prereq:* A grade of C or better in ECE 211. 3(3 0) F.S. Continuation of study of electric circuits. Multi port networks, two port networks with energy storage, ideal transformers. Analysis and design of nonlinear devices and linear models, load-line methods, diodes, and transistor models. Transients in linear circuits, complex impedance. AC power and three phase circuits. Y-Delta equivalents, complex power. Amplifiers and frequency response, s domain, Bode plots, filters. Matrix methods in circuit analysis and design.

ECE 223 Electric Circuits II Laboratory. *Coreq:* ECE 221. 1(0 3) F.S. Laboratory work on material treated in ECE 221 emphasizing elementary design principles.

ECE 301 Linear Systems. *Prereq:* A grade of C or better in ECE 221. 3(2 2) F.S. Representation and analysis of linear systems using differential equations: impulse response and convolution, Fourier series, and Fourier and Laplace transformations. Emphasis on interpreting system descriptions in terms of transient and steady-state response. Analysis of discrete time systems.

ECE 303 Electromagnetic Fields. *Preqs:* MA 341 and a grade of C or better in ECE 221. 3(3 0) F.S. Static electric and magnetic fields. Early experimental laws and their relation to Maxwell's equations. Force laws and particle ballistics. Propagation, reflection and refraction of plane waves. Transient and steady-state behavior of waves on transmission lines.

ECE 305 Electric Power Systems. *Prereq:* A grade of C or better in either ECE 221 or ECE 331. 3(3 3) F.S. Principles, performance and characteristics of power-system components, including direct-current and alternating-current machinery, transformer banks and transmission lines. Principles and analysis of system power flow.

ECE 314 Electronic Circuits. *Prereq:* A grade of C or better in ECE 221. 3(3 3) F.S. Design concepts for digital and analog integrated circuits such as logic gates, memory, and operational amplifiers employing junction diodes, bipolar junction transistors and field effect (MOS) transistors.

ECE 331 Principles of Electrical Engineering I. *Preqs:* MA 241, PY 208. Not available to EE and CPE majors. 3(3-0) F.S. Sum. Concepts, units and methods of analysis in electrical engineering. Analysis of d-c and a-c circuits, characteristics of linear and non linear electrical devices, transformers, motors and control systems.

ECE 332 Principles of Electrical Engineering II. *Prereq:* ECE 331. Not available to EE and CPE majors. 3(3 0) F.S. Sum. Principles of electronics, instrumentation and computers. Digital gates and logic systems, operational amplifiers with applications in instruments and analog computers, measuring instruments, microcomputers, sensors and transducers.

ECE 339 Principles of Electrical Engineering Laboratory. *Coreq:* ECE 331. Not available to EE and CPE majors. 1(0 3) F.S. Laboratory work in the material covered in ECE 331.

ECE 341 Solid-State Devices. *Prereq:* A grade of C or better in ECE 221. Credit is not permitted in both ECE 341 and ECE 441. 3(3-0) F.S. Basic principles required to understand the operation of modern solid state devices. Derivation of electrical characteristics of devices such as diodes, bipolar transistors, MOS transistors and LEDs. Applications to design of electronic circuits.

ECE 342 Design of Complex Digital Systems. *Prereq:* A grade of C or better in ECE 218. 3(3 3) F.S. Design principles for complex digital systems; Iteration, top down/bottom-up, divide and conquer, and decomposition. Descriptive techniques, including block diagrams, timing diagrams, register transfer, and hardware-description languages. Consideration of transmission line effects on digital systems.

ECE 401 Introduction to Signal Processing. *Preqs:* ECE 301, ECE 302 or 221. MA 314. 3(3-0) F.S. Concepts of electrical signal processing. Fourier series, Fourier transform, Z-transform, advanced linear systems and stochastic processes. Analog/digital and digital/analog conversion, digital filters and modulation. Major design project.

ECE 409 Introduction to Telecommunications Engineering. *Preq: ECE 301, MA 314. 3(3-0) F.S.* Design and operation of telecommunications systems: switching hierarchy, characteristics of signals and impairments, measurements of signals and noise, transmission media, teletraffic theory, switching systems.

ECE 431 Electronics Engineering. *Preqs: ECE 301, ECE 314. 3(2-3) F.S.* Design and analysis of discrete and integrated electronic circuits, from single-transistor stages to operational amplifiers, using bipolar and MOS devices. Feedback in operational amplifier circuits, compensation and stability. Laboratory design projects.

ECE 432 Communication Engineering. *Preqs: ECE 301, ECE 314, MA 314. 3(2-3) F.S.* Fundamentals of communications engineering. Elements of systems including modulators, demodulators, transmitters, receivers. Bandwidth allocation and optimization examined in time and frequency domains. Laboratory design project involving a complete communications system.

ECE 435 Elements of Control. *Preqs: ECE 301, ECE 221, ECE 314. 3(2-3) F.* Analog system dynamics, open and closed loop control, block diagrams and signal flow graphs, input-output relationships, stability analyses using Routh-Hurwitz, root-locus and Nyquist, time- and frequency-domain analysis and design of analog control systems.

ECE 436 Digital Control Systems. *Preq: ECE 435. 3(3-0) S.* Discrete systems dynamics, sampled data systems, mathematical representations of analog digital and digital analog conversions, open- and closed-loop systems, input output relationships, state space and stability analyses, time- and frequency-domain analyses. Design of digital controllers.

ECE 439 Integrated Circuit Technology and Fabrication. *Preq: ECE 341 or 441. 3(2-2) F.* Semiconductor device and integrated-circuit processing and technology. Wafer specification and preparation, oxidation, diffusion, ion implantation, photolithography, design rules and measurement techniques.

ECE 441 Introduction to Solid-State Devices. *Preqs: ECE 314, ECE 303. 3(3 0) F.* Basic principles required to understand the operation of solid state devices. Semiconductor device equations developed from fundamental concepts. P-N junction theory developed and applied to the analysis of devices such as varactors, detectors, solar cells, bipolar transistors, field-effect transistors. Emphasis on device physics rather than circuit applications.

ECE 444 Computer Control of Robots. *Preqs: ECE 314 and a grade of C or better in ECE 218. 3(2-3) F.S.* Techniques of computer control of industrial robots: interfacing with synchronous hardware including analog digital and digital/analog converters, interfacing noise problems, control of electric and hydraulic actuators, kinematics and kinetics of robots, path control, force control, sensing including vision. Major design project.

ECE 446 VLSI Systems Design. *Preqs: ECE 314 and a grade of C or better in ECE 218. 4(3 2) F.S.* Digital systems design in MOS VLSI technology: MOS device physics, fabrication, primitive components, design and layout methodology, integrated systems, architectures, timing and testing. Trends in VLSI technology. Major design project.

ECE 448 Transmission Lines, Waveguides and Antennas. *Preq: ECE 303. 3(3 0) F.* Transmission and propagation of electromagnetic waves by means of transmission lines, waveguides and antennas. Striplines, directional couplers, metal waveguides, optical fibers and elementary antennas.

ECE 451 Power System Analysis. *Preq: ECE 305. 3(3-0) F.* Long distance transmission of electric power with emphasis on load flow, economic dispatch, fault calculations and system stability. Applications of digital computers to power-system problems. Major design project.

ECE 452 Power Systems Protection. *Preq: ECE 451. 3(3-0).* Elements of protective systems. Principles, construction and operating characteristics of different types of relays. Relays as comparators. Instrument transformers for relaying. Principles and applications of overcurrent, differential, distance and carrier protection. Introduction to digital protection. Design project.

ECE 453 Distribution System Analysis, Design and Operation. *Preq: ECE 305, 3(3-0)* S. Electric power distribution systems: load characteristics, short-term load forecasting, capacitive compensation, voltage regulation and control. Distribution transformers. Design of subtransmission and distribution substations, distribution primary systems. Distribution system operations and automation.

ECE 454 Electric Machinery. *Preq: ECE 305, 3(3-0)* S. Magnetic circuits, transformers, forces and torques in singly and multiply-excited magnetic fields, dynamic equations of electromechanical devices, principal concepts of rotating machines. Performance of d.c. synchronous and induction machines in transient and steady states.

ECE 455 Computer Control of SCR Motor Drives. *Preq: ECE 305 or ECE 331, 3(1-4)* S. Principles of design of silicon-controlled rectifier (SCR) drives for d-c motors operating from single or three phase a-c sources. Feedback strategies for computer control of SCR firing angles. Major design project.

ECE 457 Semiconductor Power Conversion. *Preq: ECE 314, 3(3-0)* F. Theory and practice of using diodes and thyristors for large-scale conversion of electric power. Rectification, commutation, faults, input output harmonic content, phase control of power flow. Inverters and modes of operation. Bi directional (four-quadrant) power-flow control techniques.

ECE (CSC) 460 Digital Systems Interfacing. *Preq: A grade of C or better in either ECE 218 or CSC 312, 3(2-3)* F.S. Concepts of microcomputer system architecture and applications to fundamental computer hardware. Theoretical and practical aspects of interfacing and a variety of microprocessor peripheral chips with specific microprocessor microcomputer systems from both hardware and software points of view.

ECE 463 Advanced Microprocessor Systems Design. *Preq: ECE 342, 3(2-3)* F.S. Advanced topics in microprocessor systems design, including processor architectures, virtual-memory systems, multiprocessor systems, and single-chip microcomputers. Architectural examples include a variety of processors of current interest, both commercial and experimental. Major design project.

ECE 465 Engineering Applications of Artificial Intelligence. *Preq: Senior standing in CPE or EE, 3(3-0)* F. Engineering applications of artificial intelligence (AI): Problem solving techniques, knowledge acquisition, knowledge representation, production systems, expert systems, AI languages, neural networks, and machine learning. Design projects required.

ECE 480 Senior Design Project in Electrical Engineering. *Preqs: ECE 218, 301, 303, 305, 314, 341; COM 110; ENG 331. EE majors only, 4(3-3)* F.S. Applications of engineering and basic sciences to the total design of electrical engineering circuits and systems. Consideration of the design process including feasibility study, preliminary design detail, cost effectiveness, along with development and evaluation of a prototype accomplished through design-team project activity. Complete written and oral engineering report required.

ECE 481 Senior Design Project in Computer Engineering. *Preqs: ECE 301, 314, 342; CSC 202, 311; COM 110; ENG 331, CPE majors only, 4(3-3)* F.S. Application of engineering and basic sciences to the total design of hardware and software systems. Consideration of the design process including feasibility study, preliminary design detail, cost effectiveness, along with development and evaluation of a prototype accomplished through design-team project activity. Complete written and oral engineering report required.

ECE 492 Special Topics in Electrical and Computer Engineering. *Preq: Cl. 1-4* F.S. Offered as needed for development of new courses in electrical and computer engineering.

Selected 500-Level Courses Open To Advanced Undergraduates

Undergraduates taking 500 level ECE courses must have a B or higher average in ECE and MA courses.

ECE (CSC) 506 Digital Systems Architecture. *Preq: ECE 218 or CSC 312, 3(3-0)* F.

- ECE (CSC) 510 **Software Engineering.** *Preqs: CSC 311 and CSC 322 or equivalent. 3(3-0) F.*
- ECE 511 **Analog Electronics.** *Preq: ECE 431. 3(2 3) F.*
- ECE (CSC) 512 **Compiler Construction.** *Preq: CSC 311. 3(3-0) S.*
- ECE (CSC) 513 **Digital Signal Processing.** *Preq: ECE 401. 3(3 0) S.*
- ECE 514 **Random Processes.** *Preq: ECE 301. 3(3-0) F.*
- ECE 516 **System Control Engineering.** *Preq: ECE 435 or ECE 301. 3(3 0) F.*
- ECE (CSC) 520 **Fundamentals of Logic Systems.** *Preq: ECE 218. 3(3 0) F.*
- ECE (CSC) 521 **Digital Computer Technology and Design.** *Preq: ECE 342. 3(3 0) S.*
- ECE 525 **Optical Signal Processing.** *Preq: ECE 301. 3(3-0) F.*
- ECE 530 **Physical Electronics.** *Preq: ECE 303. 3(3-0) F.*
- ECE 531 **Principles of Transistor Devices.** *Preq: ECE 441. 3(3 0) S.*
- ECE 532 **Principles of Microwave Circuits.** *Preq: ECE 448. 3(3-0) F.*
- ECE (CSC) 533 **Digital Electronics.** *Preq: ECE 314. 3(3 0) S.*
- ECE 537 **Microwave Device Characterization Techniques.** *Preq: ECE 448. 3(1-5) F.*
- ECE 538 **Integrated Circuit Technology and Fabrication.** *Preq: ECE 441. 3(3 0) F.*
- ECE 540 **Electromagnetic Fields.** *Preq: ECE 448. 3(3 0) S.*
- ECE (CSC) 542 **Database Management.** *Preq: CSC 431 or CSC (ECE) 501. 3(3 0) F.*
- ECE 547 **VLSI Architecture.** *Pr qs: ECE 446, ECE 401. 3(3 0) S.*
- ECE 550 **Power System Operation and Control.** *Preqs: ECE 305 or ECE 331. 3(3-0) F.*
- ECE (CSC) 571 **Data Transmission/Communications.** *Preqs: CSC 312 or ECE 218; ECE 301. 3(3 0) S.*
- ECE (CSC, CSE) 572 **Computer Communications.** *Preq: CSC 312 or ECE 218. 3(3 0) F.*
- ECE 591, 592 **Special Topics in Electrical and Computer Engineering.** *Preq: Cl. 3(3 0) F,S.*
- ECE 593 **Individual Topics in Electrical and Computer Engineering.** *Preq: Cl. 1-3 F,S.*

CURRICULUM AND INSTRUCTION

ECI 102 **Orientation to Middle Grades Education.** *Restricted to MSL majors and unclassified students in MSL certification program only. 0(1-0) F,S.* Orientation and introduction to department, college, and university expectations and procedures. Advisor advisee interaction and discussion of practical aspects of academic life. HARPER

ECI 105 **Reading and Learning Strategies for Academic Performance.** *Credit is not applicable toward graduation in any curriculum. 3(3 0) F,S.* Provides instruction and practice in academic reading and learning strategies; emphasis is placed on the process of comprehending and retaining textbook and lecture information in order to enhance performance in academic courses.

ECI 205 **Introduction to Teaching Humanities and Social Sciences.** *Preq: Sophomore standing. 3(2 3) S.* For prospective teachers in secondary and middle years social studies, English, language arts, and foreign languages. An emphasis on differing aspects and procedures of instruction and analysis of the competencies required of teachers. Field work in a variety of educational settings including an extended period in one curriculum area.

ECI 210 College Tutoring. *Registration priority will be given to students who plan to become tutors or who are tutoring.* 2(2 0) F,S. Develop skills in general tutoring. Areas of emphasis include recognizing and responding to various learning difficulties, implementing a variety of tutoring methods and developing self-evaluation of effective tutoring skills.

ECI 296 Special Topics in Education. 1-3, F,S,Sum. Individual or group study of particular areas of education at the freshman and sophomore levels. Specific topics will vary from semester to semester.

ECI 305 Principles of Teaching Diverse Populations. *Preq: ECI 205 or EMS 203.* 3(3 0) F,Sum. Impact of cultural factors on experiences of teachers and students in contemporary schools. Teaching techniques and development of instructional plans to enhance schooling experiences of culturally diverse students.

ECI 306 Middle Years Reading. *Preq: 6 hours ED and or PSY.* 3(3 0) S. Methods and materials for teaching reading skills in middle years with emphasis on application of the reading process to content area reading.

ECI 307 Teaching Writing Across the Curriculum. *Preq: ENG 112.* 3(3 0) S. Designed for prospective teachers of all disciplines and grade levels. Practical strategies for using writing as a learning tool and enhancing composing ability. Students participate as writers and learners while developing writing lessons and assignments appropriate to their content areas. Separate sections for Middle Grades (MSL) and English majors (LTN).

POPE, PRITCHARD

ECI 309 Teaching in the Middle Years. *Preq: 6 hours ED PS Y.* 3(3-0) F, S. Examines the nature and purposes of middle level schools. Explores early adolescent development, curriculum, teaching learning methods, school organization, and characteristics of effective middle years teachers.

ARNOLD

ECI (ENG) 405 Literature for Adolescents. *Preq: Junior standing or above.* 3(3-0) F. Reviews the history, types, and characteristics of literature for adolescents. Emphasizes reading and analyzing the literature by exploring the themes, literary elements, and rationale for teaching literature for adolescents. Addresses ways in which this literature can be integrated and implemented in English Language Arts curriculum.

POPE

ECI 414 Human Relations and Discipline in the Classroom. *Preqs: PSY 304 and 6 hours of education.* 3(3 0) Alt. Yrs. Designed to help prospective teachers foster positive interpersonal relationships in classrooms, build a sense of community and create a purposive environment for learning. Investigates issues such as group building, active listening, and major approaches to discipline. Uses case studies and problem solving methods.

ECI 415 The Arts and Adolescence. *Preq: 6 hours ED and or PSY; Middle Grades majors (MSL, MSD).* 3(2-0) S. Relationship of the arts to the academic work of adolescent learners. Arts and adolescent development: arts and learning processes within and outside of the classroom; experimentation and skill development in graphic arts, sculpture, music, drama, dance movement, film, and poetry.

ECI 416 Teaching Exceptional Students in the Mainstreamed Classroom. *Preq: Six hours ED and or PSY.* 3(3 0) S. Provides classroom teachers in all disciplines and grade levels with a knowledge of various handicapping conditions, as well as with techniques to assist exceptional students within the mainstreamed classroom. Required for MSL majors.

ECI 423 Methods and Materials in Teaching Modern Foreign Languages. *Preq: Admission to professional semester; Coreq: ECI 424.* 5 credits (Course scheduled 15 hrs, each week for 7 weeks of which eight days [24 class hrs.] is practicum.) F. Methods and materials for teaching modern languages K-12 including the use of instructional media.

ECI 424 Student Teaching in French or Spanish. *Preq: Admission to professional semester; Coreq: ECI 423.* 8(2 15) F. Provides prospective teachers of French or Spanish a ten-week teaching experience in a selected school, under the supervision of a cooperating high school teacher and a university faculty supervisor.

MALINOWSKI

ECI 430 Methods and Materials for Teaching Language Arts in the Middle Grades.

Preq: Admission to professional semester. 4(3 2) F. Demonstration and activity-oriented course provides opportunities for prospective teachers to integrate their knowledge of subject matter with effective materials and methods of instruction. Students make guided observations, plan lessons and units, and practice varied classroom models and strategies in micro lessons. Prepares students for their responsibilities in teaching language arts in the middle schools.

POPE

ECI 435 Methods and Materials for Teaching Social Studies in the Middle Grades.

Preq: Admission to professional semester. 4(3 2) F. Teaching techniques and development of teaching and evaluation skills in middle grades social studies. Adapting instruction to individual learner differences. Creating instructional materials appropriate for use in social studies teaching.

MARTORELLA

ECI 450 Methods and Materials in Teaching English.

Preqs: ECI 205, ELP 344, PSY 304; senior standing and admission to Teacher Education candidacy with a major in English. Taught during the first seven weeks of the semester. 4(3 2) F. Methods and materials of teaching English in grades 9-12, with an emphasis on lesson planning and demonstrations practice in teaching literature, study skills, speaking, listening, and writing.

PRITCHARD

ECI 451 Improving Reading in Secondary Schools.

Preq: 6 hours of ED and or PSY. 2(2-0) F.S.Sum. A study of methods and materials for teaching reading in the secondary school, with an emphasis on the effective use of written materials for content area instruction.

FOX

ECI 454 Student Teaching in English Language Arts.

Preqs: Admission to student teaching professional semester. For MSL students: ECI 430; 416, 464. For LTN students: ED 450. 1-8 S. Provides the prospective teacher with experience in the techniques and skills involved in teaching English or Language Arts. Ten weeks in a selected off campus station. Student teachers become familiar with the total school program and participate in selected school and community activities.

POPE, PRITCHARD

ECI 460 Methods and Materials in Teaching Secondary School Social Studies.

Preqs: ECI 205, ELP 344. Sr. standing and admission to professional semester with a major in either history, sociology, political science. Taught during the first seven weeks of the semester. 4(3 1) F. Teaching techniques, innovations, and development of teaching and evaluation skills in the area of secondary school social studies. Adaptation of instruction to individual learner differences, and selection and design of instructional materials. Taught during the first seven weeks of the semester.

HARPER

ECI 464 Student Teaching in Social Studies.

Preqs: Admission to professional semester. Coreq: for LTH, LTP, LTS students: ECI 460. For MSL students: ECI 454, 430, 416. 3-8 (2-18) S. Skills and techniques in teaching social studies in secondary and middle schools. Each student spends ten weeks in a selected off-campus center. The student demonstrates competencies essential for teaching social studies, becomes familiar with the total school program, and participates in a variety of school and community activities.

HARPER, POPE

ECI 483 An Introduction to Media and Instructional Technology.

Preq: Junior standing. 3(3 0) F.S. Survey of instructional media and instructional technology. Relationship between media and instructional objectives. Projects in designing and developing instructional media materials and using instructional computing software.

VASU

ECI 488 Basic American Sign Language.

3(3 0) F.S. Skill training in basic vocabulary acquisition and grammar of American Sign Language, ASL, used by a majority of deaf people who sign.

ECI 496 Special Topics in Education.

Preq: Junior or senior standing and consent of instructor. 1-3 F.S.Sum. Individual or group study of special topics in professional education. The topic and mode of study are determined by the faculty member after discussion with the student.

EDUCATION

ED 103 Teaching Fellows Seminar. *1(0-2) F.* An orientation to academic requirements of higher education, a review of teacher education components and elements of teacher education curricula, identification of characteristics of an effective student, and an introduction to instructional methods and issues in the field of education.

ED 111 Education and Psychology Scholars Forum. *Prereq: Enrollment limited to participants in the Education and Psychology Scholars Program, 0(2-0) F.S.* Interdisciplinary seminar with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

ED 211 Education and Psychology Scholars Forum. *Prereq: Enrollment is limited to participants in the Education and Psychology Scholars Program, 0(2-0) F.S.* Second level of interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

EDUCATIONAL LEADERSHIP AND PROGRAM EVALUATION

ELP 201 Alternative Education Agencies. *3(3-0) F.* Explores alternate forms of education beyond the setting of the formal school. Content includes a variety of educative mechanisms in society as they relate to socio economic and demographic characteristics and emerging values.

ELP 296 Special Topics in Education: General Studies. *1-3, F.S., Sum.* Individual or group study of particular areas of education at the freshman and sophomore levels. Specific topics will vary from semester to semester.

ELP 344 School and Society. *Prereq: Jr. standing, 3(3-0) F.S., Sum.* The interrelationship between the school and other institutions, values, and patterns of thought in American society.

EAKER, BITTING, SEROW

ELP 496 Special Topics in Education: General Studies. *Prereq: Junior or senior standing and consent of instructor, 1-3 F.S., Sum.* Individual or group study of special topics in professional education. The topic and mode of study are determined by the faculty member after discussion with the student.

MATHEMATICS/SCIENCE EDUCATION

EMS 101 Orientation to Mathematics and Science Education. *Open only to students in Math and Science Education, 0(1-0) F.S.* Overview of departmental expectations and procedures and introduction to practical aspects of academic life. Opportunity for interaction of students with advisors and with other undergraduates who are nearing completion of programs.

EMS 203 Introduction to Teaching Mathematics and Science. *3(2-3) F.S.* Introduces prospective teachers to the teaching of mathematics and science in the middle school and high school. As an important part of the course, students serve as teacher assistants to a classroom teacher. Ideas and questions arising from this experience provide an integral part of the classroom instruction on campus.

ANDERSON, NORWOOD, WATSON, WHEATLEY

EMS 296 Special Topics in Education. *1-3, Individual or group study of particular areas of education at the freshman and sophomore levels. Specific topics will vary from semester to semester.*

EMS 470 Methods and Materials for Teaching Mathematics. *Prq: Admission to professional semester. Taught during the first seven weeks of the semester. 3(3 0) F.* A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of mathematics at the secondary level.

KOLB, NORWOOD, STIFF, WATERS, WATSON

EMS 471 Student Teaching in Mathematics. *Prq: Admission to professional semester. Coreqs: EMS 470. 3 8 F.* Supervised practice in a selected middle or secondary school for 10 weeks, to develop the skills and techniques for teaching mathematics.

KOLB, NORWOOD, STIFF, WATERS, WATSON

EMS 472 Teaching Mathematics Topics in Senior High. *Prq: Admission to professional semester. Coreq: EMS 470. Taught during the first 7 weeks of the semester. 3(3 0) F.* Preparation for teaching mathematics from both the college preparatory (algebra, geometry, trigonometry, advanced mathematics) and general courses (general mathematics, technical and consumer mathematics) offered in grades 9-12.

KOLB, NORWOOD, STIFF, WATERS, WATSON

EMS 474 Teaching Mathematics Topics in the Middle Grades. *Prq: Admission to professional semester; Coreq: EMS 470. Taught during the first 7 weeks of the semester. 3(3 0) F.* Methods of teaching arithmetic, geometry, and pre algebra topics in grades 6-9. Emphasizes approaches that actively involve learners and relate operations on content and pictorial representations to mathematical symbols.

KOLB, NORWOOD, STIFF, WATSON

EMS 475 Methods of Teaching Science. *Prqs: EMS 203, ELP 344, PSY 304. Coreq: EMS 476. Taught during the first seven weeks of the semester. 3(3 0) F.* Goals, methods, curricula, and evaluation practices in teaching the physical and biological sciences at the middle and secondary school levels.

ANDERSON, PARK, WESTBROOK, WHEATLEY

EMS 476 Student Teaching in Science. *Prqs: EMS 203, ELP 344, PSY 304. Coreq: EMS 475. Students must have senior standing and be admitted to the professional semester. 3-8. F.* Supervised classroom experience in developing the skills and techniques for teaching science in a selected middle or secondary school for 10 weeks.

ANDERSON, PARK, WESTBROOK, WHEATLEY

EMS 477 Instructional Materials in Science. *Prqs: EMS 203, ELP 344, PSY 304. Coreqs: EMS 475, 476. Part of professional semester; 2 lecture hours and 6 lab hours per week for 7 weeks. 2(1 3) F.* Development and selection of teaching materials that reflect concepts of content and emphasis in middle and secondary school science. Experimental and laboratory approaches.

ANDERSON, PARK, WESTBROOK, WHEATLEY

EMS 480 Teaching Mathematics with Microcomputers. *Prqs: CSC 101, EMS 203; MA 141, 112, or 131. 3(2-2) F.S.* Techniques and skills needed to use the microcomputer as a tool in mathematics learning. Issues and research findings affecting the use of microcomputers in mathematics instruction. Development of computing and problem solving skills in areas of the secondary school mathematics curriculum such as algebra, geometry and statistics.

KOLB, NORWOOD, STIFF

EMS 495 Senior Seminar in Mathematics and Science Education. *Prq: Advanced undergraduate and consent of department. 1 J.* An in depth investigation of a teaching area in mathematics or science education during or after the student teaching semester.

EMS 496 Special Topics in Education. *Prq: Junior or senior standing and consent of instructor. 1 3.* Individual or group study of special topics in professional education. The topic and mode of study are determined by the faculty member after discussion with the student.

ENGLISH

FRESHMAN ENGLISH

ENG 110 Developmental English. *Credit is not applicable toward graduation in any curriculum. Students placed in ENG 110 must receive a grade of S in order to advance to ENG 111.* 3(3-0) F,S,Sum. Development of basic writing skills through supervised writing, analyzed readings, and self-paced drills. Parts of speech; principles of spelling, capitalization, and punctuation; vocabulary study; composition of sentences, simple paragraphs, and short essays. Role of invention and revision in the writing process.

ENG 111 Composition and Rhetoric. *Successful completion of ENG 111 requires a grade of C or better.* 3(3-0) F,S,Sum. Basic forms and principles of expository and argumentative writing. Grammar and conventions of standard written English. Strategies for generating, organizing, and revising papers. Procedures of library research and use of evidence.

ENG 112 Composition and Reading. *Preq: A grade of C or better in ENG 111.* 3(3-0) F,S,Sum. Continued practice in expository writing; numerous short themes and a research paper; introduction to literary types; frequent conferences.

NOTE: ENG 111 and 112 must be scheduled in successive semesters until they are completed satisfactorily.

NOTE: Qualified students will be allowed to register for ENG 112H and will be given credit for ENG 111 upon successful completion of the course. Eligibility for ENG 112H is based on the student's predicted grade in English.

WRITING AND LANGUAGE

The prerequisite for all courses in writing and language at the 200 level and above is the completion of ENG 111 and ENG 112.

ENG 214 Introduction to Editing. 3(3-0) F,S,Sum. Basic editorial skills for working with a wide range of publications. Stylistic editing (conventions of written English, consistency, effectiveness of syntax, appropriateness of diction), substantive editing (accuracy, legal issues, ethics), and production editing (layout, typography, electronic publication processing). Introduction to resources such as standard reference works and professional organizations.

ENG 215 Principles of News and Article Writing. 3(3-0) F,S,Sum. Techniques of writing news stories and feature articles. Components of newsworthiness, examination of evidence, interview techniques, varied writing styles. Role of newspapers and journalism in America.
COCKSHUTT, KOCHERSBERGER

ENG 288 Fiction Writing. 3(3-0) F,S. Experience in writing short prose fiction. Class critiquing of student work and instruction in techniques of fiction.
DAVIS GARDNER, KESSEL

ENG 289 Poetry Writing. 3(3-0) F,S. Experience in writing poetry. Class critiquing of student work and instruction in techniques of poetry.
BARRAX, KATZ

ENG 315 Advanced News and Article Writing. *Preq: ENG 215.* 3(3-0) S. A journalism course emphasizing writing news stories, profiles, features and investigative stories and including analysis and critical reading of print media.
COCKSHUTT, KOCHERSBERGER

ENG 322 Advanced Composition and Rhetoric. *Preq: Junior standing.* 3(3-0) F,S,Sum. Classical and modern views of rhetoric and psychological and social aspects of writing. Varied practice in writing; assignments with different audiences, aims, contexts, and conventions.
CARTER, C. MILLER, PENROSE

ENG 324 Modern English. 3(3-0) F. Study of Modern English at the sentence level. Analysis of grammatical structure. Problems of composition and variety in language.
CHASKI, FENNELL, HOLLOWAY, WOLFRAM

ENG (FL) 325 Linguistic Awareness. *3(3 0) S.* Basic issues in the study of language: linguistic terminology and categories; grammatical traditions and topics such as prescriptivism and descriptivism, standard and non standard, orality and literacy; language acquisition and awareness; language aesthetics and ethics.

ENG 326 History of the English Language. *3(3 0) S.* Development of the English language from its Indo-European origins to the present. Emphasis on historical and comparative linguistic methodology and on detailed changes in sound, syntax, and meaning. FENNEL, MEYERS

ENG 331 Communication for Engineering and Technology. *Preq: Junior standing. Credit is not allowed for more than one of ENG 331, ENG 332, and ENG 333. 3(3-0) F,S,Sum.* Written communication in industrial and technical organizations, emphasizing internal communication with managers and technical personnel and including external communication with regulators, vendors, and clients. Intensive practice in writing; relationship of writing to oral and visual communication. For students in engineering and other primarily technological curricula.

ENG 332 Communication for Business and Management. *Preq: Junior standing. Credit is not allowed for more than one of ENG 331, ENG 332, and ENG 333. 3(3-0) F,S,Sum.* Written communication in business and public organizations, including both internal communication (such as instructions, policies, management reports) and external communication with clients, vendors, and publics. Intensive practice in writing; relationship of writing to oral and visual communication. For students in business and management-related programs.

ENG 333 Communication for Science and Research. *Preq: Junior standing. Credit is not allowed for more than one of ENG 331, 332, and 333. 3(3-0) F, S.* Written communication in scientific and research contexts, emphasizing relationship between research and writing in problem formulation, interpretation of results, and support and acceptance of research. Intensive practice in writing; relationship of writing to oral and visual communication. For students who plan careers in scientific research.

ENG 488 Advanced Fiction Writing. *Preq: A grade of B or better in ENG 288 or 289, or demonstrated competence in creative writing. 3(3 0) F,S.* Workshop in creative writing for the student with demonstrated understanding of the basic techniques of writing prose fiction. DAVIS-GARDNER, KESSEL, SMITH

ENG 489 Advanced Poetry Writing. *A grade of B or better in ENG 288 or 289, or demonstrated competence in creative writing. 3(3 0) S.* Workshop in creative writing for the student with demonstrated understanding of the basic techniques of writing poetry. BARRAX

ENG 495 Seminar in Writing and Editing. *Preq: Senior standing in LWE. 3(3 0) F,S.* Applies principles and experiences gained in previous study to practical problems and projects such as document design and production, document testing, professional ethics, literacy education, and style analysis and evaluation. COCKSHUTT, COVINGTON, MILLER

LITERATURE

The prerequisite for all courses in literature at the 200-level and above is the completion of ENG 111 and ENG 112.

ENG 205 Studies in Great Works of Literature.* *3(3 0) F,S,Sum.* Literary master pieces from the classical period to the present. Emphasis on reading for understanding and enjoyment both of the works themselves and the cultural contributions to Western civilization of the periods from which the works are drawn.

*The courses ENG 205, 206, 207, and 208 are designed for students not enrolled in Humanities and Social Sciences

ENG 206 Studies In Drama. * *(3/3 0)* F,S. Selected drama from the classical period to the present. Emphasis on reading for enjoyment as well as understanding theory and development of tragedy, comedy, and other modes of dramatic expression.

ENG 207 Studies in Poetry. * *(3/3 0)* F, S. Analysis of poetry and the critical approaches to it. Emphasis on appreciation of the nature of poetry, understanding features and techniques, and the importance of both historical context and new critical techniques.

ENG 208 Studies In Fiction. * *(3/3 0)* F,S,Sum. Representative examples from the Renaissance to the present, emphasizing understanding and appreciation of fiction as a genre, a knowledge of the features and techniques of fiction, and a sense of the historical development of this genre.

ENG 209 Introduction to Shakespeare. *Does not satisfy requirements for English major. (3/3 0)* F,S. Shakespeare for non-English majors. Seven to ten major plays, including representative comedies, such as *The Taming of the Shrew*; histories, such as *Richard III*; tragedies, such as *Hamlet*; and romances, such as *The Tempest*. BAINES, LANE

ENG (FL) 221 Literature of the Western World I. *(3/3 0)* F. Readings from English translations of Biblical, Classical, Medieval, and Early Renaissance literature, including works by such authors as Homer, Plato, Virgil, Ovid, St. Paul, St. Augustine, Marie de France, and Dante. GROSS, SMOOT

ENG (FL) 222 Literature of the Western World II. *(3/3 0)* S. Readings from English translations of Renaissance, Neo-Classical, Romantic, and Early Modern literature, emphasizing the cultures of continental Europe from the Renaissance to 1900, and including such authors as Petrarch, Erasmus, Rabelais, Machiavelli, Shakespeare, Moliere, Voltaire, Rousseau, Goethe, Flaubert, Tolstoy. RUDNER, SMOOT

ENG (FL) 223 Contemporary World Literature I. *(3/3 0)* F. Twentieth century literature of some of the following cultures: Russian, Eastern European, Western European, Latin American, Canadian, Australian. RUDNER

ENG (FL) 224 Contemporary World Literature II. *(3/3 0)* S. Twentieth-century literature of some of the following cultures: Asian, Arabian, African, Caribbean, Native-American. NWANKWO, RUDNER

ENG 246 Literature of the Holocaust. *(3/3 0)* Alt. Yrs. S. Fictional and nonfictional versions of the Holocaust, focusing on themes of survival, justice, theology, and the limits of human endurance. RUDNER

ENG 248 Survey of African-American Literature. *(3/3 0)* F,S. African American writing and its relationships to American culture and history. Covers such writers as Wheatley, Douglass, Chesnutt, Dunbar, DuBois, Hughes, Hurston, Wright, and Morrison. LARYEA, PETTIS

ENG 251 Major British Writers. *Credit will not be given for both ENG 251 and either ENG 261 or 262. (3/3-0)* F,S,Sum. Significant British authors chosen from among such figures as Chaucer, Shakespeare, Milton, Swift, Pope, Austen, Wordsworth, Coleridge, Tennyson, Browning, Bronte, Dickens, Joyce, Eliot, Woolf, and Yeats.

ENG 252 Major American Writers. *Credit will not be given for both ENG 252 and either ENG 265 or 266. (3/3 0)* F,S,Sum. Significant American authors chosen from among such figures as Franklin, Emerson, Thoreau, Hawthorne, Melville, Douglass, Stowe, Whitman, Dickinson, Twain, James, Frost, Faulkner, Hemingway, and Morrison.

ENG 261 English Literature I. *(3/3 0)* F,S,Sum. Survey of English literature from its beginnings until 1660, including such figures as Chaucer, Spenser, Marlowe, Shakespeare, Jonson, Donne, and Milton.

ENG 262 English Literature II. *(3/3 0)* F, S,Sum. Survey of English literature from 1660 to the present, including such figures as Dryden, Pope, Swift, Johnson, Wordsworth, Coleridge, Byron, Keats, Shelley, Browning, Tennyson, Joyce, and T. S. Eliot.

*The courses ENG 205, 206, 207, and 208 are designed for students not enrolled in Humanities and Social Sciences.

- ENG 265 American Literature I.** *3(3 0) F,S,Sum.* Survey of American literature from the Colonial beginnings until the Civil War, including such figures as Edwards, Franklin, Irving, Cooper, Hawthorne, Emerson, Melville, Poe, and Thoreau.
- ENG 266 American Literature II.** *3(3 0) F,S,Sum.* Survey of American literature from the Civil War to the present, including such figures as Whitman, Dickinson, Twain, Crane, James, Frost, Eliot, Fitzgerald, Hemingway, and Faulkner.
- ENG 282 Introduction to Film.** *3(2-2) F,S.* Examination of basic film techniques and basic methods of film analysis. Emphasis on understanding and appreciating film as a major art form. GOMEZ, MORRISON
- ENG 283 Introduction to American Folklore.** *3(3 0) S.* Principal types of folklore: field work in collecting and assimilating material from various cultural traditions. Emphasis on American folklore and its origins. BETTS, PRIOLI
- ENG 298 Special Projects in English.** *1 3 F,S,Sum.* Faculty guided independent study, or courses on special topics determined by departmental interest or need.
- ENG 305 Women in Literature: Female Writers and Their Female Characters.** *3(3 0) S.* Diverse images of women and cultural assumptions about women in nineteenth and twentieth-century American and British literature by women writers. The female literary imagination as it pertains to female characters and issues particularly relevant to women. ORR, PETTIS, SEVERIN
- ENG 349 African Literature in English.** *3(3 0) S.* Anglophone literature in Africa. Emphasis on the relationship between the African world view and literary production and the persistent trend by African writers to connect literature with politics. Writers such as Achebe, Ngugi, Soyinka, and Serote. NWANKWO
- ENG 362 The British Novel of the 18th Century.** *3(3 0) S.* Emphasizes major novelists such as Defoe, Richardson, Fielding, Sterne, and Austen. WYRICK
- ENG 363 The British Novel of the 19th Century.** *3(3 0) F.* Emphasizes major novelists such as Dickens, Trollope, the Brontes, Eliot, and Hardy. KING
- ENG 369 The American Novel of the 19th Century.** *3(3 0) F.* Major novels illustrating the development of American fiction from Romanticism to Realism and Naturalism. Works by such writers as Brown, Cooper, Hawthorne, Stowe, Melville, Twain, Howells, James, Norris, Crane, Chopin, and Dreiser. PRIOLI, WEST
- ENG 371 Twentieth-Century Novels.** *3(3-0) S.* Twentieth-century British and American fiction, with emphasis on forms, themes, and social contexts, including such writers as Conrad, Lawrence, Woolf, Joyce, Faulkner, Hemingway, Wright, Ellison, Beckett, Murdoch, Bellow, and Barth. AMIRAN, E. CLARK, REYNOLDS, THOMPSON
- ENG 372 Modern Poetry.** *3(3 0) S.* English and American poetry since 1900. Emphasis on major figures such as Yeats, Eliot, Frost, Stevens, Williams, and Auden. Comparison of modern poets with more contemporary, post-1950 poets. BASSETT, SEVERIN
- ENG 376 Science Fiction.** *3(3 0) F,S.* Representative works of science fiction. Emphasis on works written in the twentieth century, with some attention to the history and development of the genre. KESSEL, MEYERS
- ENG 377 Fantasy.** *3(3 0) F,S.* Representative works in the genre of fantasy. Emphasis on works of 19th and 20th centuries. Authors such as Carroll, Lewis, Tolkien, Borges, LeGuin, and Gardner. KESSEL, MEYERS
- ENG 380 Modern Drama.** *3(3-0) F.* Major plays from Ibsen to Albee. HARGRAVE
- ENG 382 Film and Literature.** *3(2 2) F.* Ways of adapting literary works to film form. Similarities and differences between these two media. Emphasis on the practical art of transforming literature into film. Attention to the impact of film upon literature. GOMEZ, MORRISON

ENG 383 Folklore and Literature. *3(3-0) F.* Relationships between traditional culture and written literature. Genre theory; interchanges between print media and oral tradition; nature of plot, character, and form in Western and non-Western cultural traditions; performance theory. Influence of regional traditions and American literature.

ENG 385 Biblical Backgrounds of English Literature. *3(3 0) Alt. yrs. F.* Influences of the Bible—principal forms, genres, and texts—on major English and American writers such as Milton, Spenser, Melville, Eliot, and Faulkner. WALL

ENG 390 Classical Backgrounds of English Literature. *3(3 0) S.* Acquaints student with the central story matter, classical and biblical, of the ancient Western world. Emphasis on works most influential on literature in English. All readings in English. YOUNG

ENG (FL) 394 Studies in World Literature. *3(3 0) F.S.* Study of a subject in world literature; for example, African literature, Asian literature, Hispanic literature, East European literature, comedy, the epic, the lyric, autobiography, the Faust legend, or metamorphosis. Subjects vary according to availability of faculty. Readings in English translation.

ENG 398 Contemporary Literature I (1900 to 1940). *3(3 0) F.* British and American literature from 1900 to World War II, with representative authors such as Conrad, Yeats, Eliot, Joyce, Woolf, Faulkner, Shaw, Stein, O'Neill, and Wright. For comparative purposes, continental authors such as Kafka and Mann.

CLARK, GRIMWOOD, THOMPSON, UNSWORTH

ENG 399 Contemporary Literature II (1940 to Present). *3(3 0) S.* Literature from World War II to the present, with representative authors such as Murdoch, Beckett, Nabokov, Ginsberg, Achebe, Fuentes, Kundera, Naipaul, and Morrison.

AMIRAN, GRIMWOOD, RUDNER, THOMPSON, UNSWORTH

ENG 400 Applied Criticism. *Preqs: Majors in LTN; senior standing; formal admission to the methods and student teaching courses. Coreq: ECI 450. 3(3 0) F.* Types and methods of literary criticism designed specifically for students intending to teach English in high school. BETTS, MACKETHAN

ENG (ECI) 405 Literature for Adolescents. *Preq: Junior standing or above. 3(3-0) F.* The history, types, and characteristics of literature for adolescents. Emphasizes reading and analyzing the literature by exploring the themes, literary elements, and rationale for teaching literature for adolescents. Addresses ways in which this literature can be integrated and implemented in English Language Arts curriculum.

ENG 439 17th-Century English Literature. *3(3 0) S.* Works of major nondramatic literary figures in England during the period 1600-1700, such as Donne, Jonson, Herbert, Marvell, Bacon, and Browne. HESTER, WALL, YOUNG

ENG 448 African-American Literature. *Preq: Junior standing. 3(3-0) S.* Survey of African-American literature and its relationships to American culture, with an emphasis on fiction and poetry since 1945. Writers such as Bontemps, Morrison, Huston, Baldwin, Hayden, Brooks, Naylor, Harper, and Dove. HOLLOWAY, LARYEA, PETTIS

ENG 449 16th-Century English Literature. *3(3 0) F.* Nondramatic prose and poetry of the sixteenth century, with consideration of literary types and movements. Emphasis on major authors, including Sidney and Spenser. BLANK, HESTER, LANE, WALL

ENG 451 Chaucer. *3(3-0) F.S.* Introduction to the study of Chaucer through an intensive reading of *The Canterbury Tales*. FERSTER, GROSS, HOLLEY, LOMPERIS

ENG 452 Medieval British Literature. *3(3-0) S.* Readings in the rich poetic, thematic, and generic diversity of Medieval British literature. Representative selections from romance, dream vision, allegory, fabliau, lyric, chronicle, saint's life, satire, in historical and cultural contexts. Prior knowledge of Middle English unnecessary. GROSS, HOLLEY

ENG 453 The Romantic Period. 3(3-0) F. Emphasis on the major poetry of Blake, Wordsworth, Coleridge, Byron, Shelley, and Keats, with readings in Romantic prose.

HARRISON

ENG 462 18th-Century English Literature. 3(3-0) F. Major figures in English literature between 1660 and 1790. Works studied in relation to social, cultural, political, and religious developments. Emphasis on writers such as Dryden, Swift, Pope, Johnson.

DURANT, WYRICK

ENG 463 The Victorian Period. 3(3 0) S. Major British poets and selected prose writers studied against the social, economic, scientific, and theological background of the Victorian Period.

HARRISON, HUSKEY, KING

ENG 468 American Romanticism. 3(3 0) F. Major American writers from 1825 to 1865. Relationship between literary developments and social change. Emphasis on such writers as Emerson, Hawthorne, Cooper, Poe, Melville, Douglass, Stowe, Thoreau, and Whitman.

E. CLARK, PRIOLI, SMALL, STEIN, WEST

ENG 469 American Realism and Naturalism. 3(3 0) S. Major American writers from 1865 to 1914, with emphasis on novelists such as Twain, James, Howells, Chopin, and Dreiser.

BASSETT, ORR, STEIN, WEST

ENG 475 Literature, the Arts, and Mass Culture 3(3-0) F.S. A review of the debate regarding art and mass culture, with attention to recent developments in cultural theory and practice.

UNSWORTH

ENG 486 Shakespeare, The Earlier Plays. 3(3 0) F. Shakespeare's major works before 1600 with emphasis on the development of the playwright.

BAINES, LANE, CHAMPION, WILLIAMS

ENG 487 Shakespeare, The Later Plays. 3(3 0) S. Shakespeare's major works after 1600 with emphasis on the development of Shakespeare's tragedy and the end of his career.

BAINES, BLANK, CHAMPION, WILLIAMS

ENG 491 Honors in English. *Prq: Open only to English majors.* 3(3 0) F.S. Intensive course or independent study project designed as one portion of the Honors Program in English. Subject varies.

ENG 492 Special Topics in Film Styles and Genres. 3(2 2) S. Critical approaches to focused film topics involving film genres, directorial styles, or trends within a national cinema. Topics will vary from semester to semester.

ENG 493 Special Topics in Folklore. 3(3 0) S. Topics and genres in folklore, such as Folktale and Legend, Folklore and Religion, African-American Folklore. Topics will vary from semester to semester.

ENG 496 Seminar in Literary Criticism. *Prq: 9 hours of literature at the 300 level or above.* 3(3 0) F.S. Introduction to theoretical and applied criticism of literature, primarily for English majors and minors. May include traditional theory from Plato and Aristotle to New Criticism, as well as contemporary psychoanalytical, social, historical, and linguistic approaches to literature.

ENG 498 Special Topics in English. *Prq: Six hours in ENG above the 100 level.* 1 6 F.S./Sum. Directed individual study or experimental course offerings in language or literature. Individual study arranged through consultation with faculty member and department head.

Selected 500-Level Courses Open to Advanced Undergraduates

The prerequisite for all 500-level English courses is advanced undergraduate or graduate standing unless additional prerequisites are noted.

ENG 515 American Colonial Literature. 3(3-0) S. Alt. yrs.

ENG 521 Advanced Technical Writing and Editing. *Prq: ENG 214 and 331.* 3(2-1) F.S.

- ENG 524 **Introduction to Linguistics.** *3(3 0) F.*
- ENG 525 **Variety in Language.** *3(3-0) S.*
- ENG 561 **Milton.** *3(3 0) S.*
- ENG 575 **Southern Writers.** *3(3 0) S.*
- ENG 578 **English Drama 1580-1642.** *Prq; ENG 261. 3(3 0) Alt. F.*
- ENG 579 **Restoration and 18th Century Drama.** *3(3 0) Alt. S.*

ENTOMOLOGY

ENT 203 **An Introduction to the Honey Bee and Beekeeping.** *2(2-0) F.* Fundamental knowledge of beekeeping management and a general understanding of the honey bee's biology. Examines the behavior and social system of the honey bee, one of the animal world's most complex and highly organized non human societies. **AMBROSE**

ENT 301 **Introduction to Forest Insects.** *Prq; FOR 264. 3(2-2) F.* Fundamentals of morphology, classification, development, habits and control of insects attacking trees with emphasis on those injuring forests in the southeastern United States. **HAIN**

ENT (ZO) 425 **General Entomology.** *Prq; ZO 201. 3(2-3) F,Sum.* Explores the science of entomology by focusing on the basic principles of systematics, morphology, physiology, development, behavior, ecology, and control of insects. Field trips provide opportunities to collect insects and study their adaptations to a wide variety of natural environments. **MEYER**

ENT 492 **External Learning Experience.** *Prq; Sophomore standing. 1 6 F,S.* A learning experience within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by the student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

ENT 493 **Special Problems in Entomology.** *Prq; Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by the student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

ENT 495 **Special Topics in Entomology.** *1 3 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

ENT 502 **Insect Diversity.** *Prq; ENT 425 or equivalent. 4(2 4) F.*

ENT 503 **Insect Morphology and Physiology.** *Prq; CH 221, 223 and ENT 425 or equivalent. 4(3 3) S.*

ENT (ZO) 509 **Ecology of Stream Invertebrates.** *Prqs; ZO 201 or 302, BO (ZO) 360 or equivalent. 4(2 6) S.*

ENT 520 **Insect Pathology.** *Prqs; ENT 425 and MB 401 or equivalent. 3(2-3) Alt. S.*

ENT 531 **Insect Ecology.** *Prqs; ENT 425 and BO (ZO) 560 or equivalent. 3(2-2) Alt. F.*

ENT 541 **Immature Insects.** *Prq; ENT 502 or equivalent. 3(1 4) Alt. F.*

ENT 550 **Fundamentals of Insect Control.** *Prq; ENT 301 or 425. 3(2 2) F.*

ENT 562 **Insect Pest Management in Agricultural Crops.** *Prq; ENT 425 or CI. 3(3 0) Alt. S.*

ENT (FOR) 565 **Advanced Forest Entomology.** *Preq: ENT 301 or ENT 502 or CI. 3(2 2) Alt. S.*

ENT (ZO) 582 **Medical and Veterinary Entomology.** *Preqs: ENT 425 and ZO 315 or equivalent. 3(2 3) Alt. S.*

ENT 590 **Special Problems.** *Preq: CI. Credits Arranged. F.S.*

ENT 591 **Special Topics.** *Preq: CI. Credits Arranged. F.S.*

ENT 592 **Agricultural Entomology Practicum.** *Preq: Economic Entomology (ENT 562 recommended.) 3(0-9) Alt. Sum.*

OCCUPATIONAL EDUCATION

EOE 101 **Introduction to Occupational Education.** *1(1-0) F,S.* Orientation to occupational teacher education curricula. Overview of philosophy, objectives and scope of occupational education programs in the public schools; multi-cultural and individual differences of students. Orientation to microcomputers and their potential uses by occupational education teachers.

EOE 207 **Introduction to Teaching Occupational Education.** *3(2 3) F.* Introduction to teaching vocational education programs in middle and secondary schools. Field experiences and course assignments including three hours each week assisting classroom teachers in the public schools.

EOE 226 **Applications of Instructional Technology in Agricultural Education.** *3(1 4) S.* Use of microcomputers and commercially produced agricultural software; the microcomputer as a management tool; agricultural occupational applications of the microcomputer; the microcomputer as an instructional tool in agricultural classrooms, and the national Agri Data network. KIRBY

EOE 241 **Foundations of Marketing Education.** *2(2 0) F.* An introduction to marketing education and its role in secondary, postsecondary, and adult education. BURROW

EOE 298 **Special Topics in Occupational Education.** *1-3. F,S,Sum.* Individual or group study of particular areas of education at the freshman and sophomore levels.

EOE 303 **Administration and Supervision of Student Organizations.** *Preq: Sophomore standing. 3(3-0).* History and purposes of student organization activities in education. Emphasis on the administration and supervision of these activities. Special attention to the skills necessary for the successful organization, management and leadership development of student activities.

EOE 307 **Field Work in Occupational Education.** *Preqs: Sophomore standing and consent of instructor. May be repeated to a maximum of 6 credits. 2-6. F,S,Sum.* A supervised off campus field experience in Occupational Education that relates on-the-job experiences in the field to the technical competencies which are the content of the curriculum.

EOE 322 **Contemporary Vocational Agriculture.** *3(3 0) S.* Organizing, implementing, supervising, and evaluating Supervised Occupational Experience (SOE) programs and related FFA activities; advising local FFA chapters; and assisting high school students in conducting SOE programs. KIRBY

EOE 323 **Leadership Development in Agriculture.** *3(3 0) S.* Study of leadership in agricultural and related settings. MOORE

EOE 331 **Health Professions.** *Preq: For credentialled health professions only. 3(3-0) F. Alt. yrs.* An examination of key occupations and professions in the health cluster. Emphasis is on educational preparation, requirements for practice, potential advancement, inter and intra professional relationships, ethical foundations of practice, and the concept of commitment. Theoretical concept of role structure and function. AKROYD

- EOE 332 Health Promotion and Disease Prevention.** *Preq: For credentialed health professionals only. 3(3 0) S, Alt. yrs.* Emphasis on education of the public regarding general health concerns including cancer, cardiovascular disease, accident prevention, nutrition, drugs, alcohol, mental health, sexuality, and environmental hazards. RICHARDS
- EOE 333 Health Care Delivery.** *Preq: For credentialed health professionals only. 3(3 0) F, Alt. yrs.* The historical basis of health care delivery in the U. S. with emphasis on hospitals, health maintenance organizations, ambulatory care centers, ambulatory surgery, nursing homes, and private care practice. Philosophical issues of funding health care, promoting health care, and the training of health care workers. AKROYD
- EOE 335 Planning Classroom and Clinical Curricula.** *Preq: For certification majors; EOE 107, 207. For non-certification majors: EOE 107. For credentialed health professionals only. 3(3-0) F, Alt. yrs.* Procedures for planning health occupations curricula for classroom and clinical settings. Practice in writing, updating, and refining health curriculum with emphasis on selection and sequencing. Comparison of styles of writing curricula. Roles and responsibilities of health curriculum planner. RICHARDS
- EOE 336 Strategies for Teaching a Health Occupations Course.** *Preq: For credentialed health professionals only 3(3 0) F, Alt. yrs.* Planning and implementation of effective instructional strategies for clinical and classroom settings. The nature of the teaching learning process, psychological and philosophical aspects of teacher choice of various strategies. RICHARDS
- EOE 338 Medical Law and Ethics.** *Preq: For credentialed health professionals only. 3(3 0) S.* Ethical and legal issues involved in delivering health care, such as euthanasia, reproductive technology, organ transplants, patients' rights, and confidentiality. Classical ethical theories and principles. Systematic review procedures and current medical law used to examine current case dilemmas in the health professions. RICHARDS
- EOE 346 Curriculum and Methods of Teaching Marketing Education.** *Preq: EOE 244 and admission to teacher education candidacy. 3(3 0) F, Alt. yrs.* Study of the curriculum common to marketing education programs and the research behind its development. Methods common to instructional planning, implementation, and evaluation of effective marketing education programs. O'BRIEN
- EOE 365 Trade Analysis in Course Development.** *Preq: EOE 101. 3(3 0) S.* Selection and analysis of teaching activities for a functional plan of instruction. Development of instructional units based on analysis of a trade or technical occupation or activity. Preparation of a detailed course of study.
- EOE 409 Honors Seminar in Occupational Education.** *Preq: Permission of instructor. 1(1 0) F.* Topics of professional importance for occupational education honors program students. Presentations on a wide range of seminar topics and their implications for occupational education.
- EOE 422 Public Relations in Agriculture.** *Preq: AC 311. 3(3 0) F.* Development of effective public relations programs in agricultural and related occupations. Examination of problems in implementation and of communication skills needed to conduct effective public relations activities. FLOWERS
- EOE 423 Practicum in Agricultural Extension/Industry.** *Preqs: EOE 426, Senior standing and consent of instructor. 1 8, S.* Supervised practicum in an agricultural extension or industry setting in which the student participates in, and analyzes activities associated with, preparing for leadership management roles in the Agricultural Extension Service or industry. JEWELL
- EOE 424 Planning Educational Programs.** *Preq: Admission to professional semester. 3(3-0) S.* Principles of program planning applied to educational programs in agriculture; includes theory and field experiences in planning, organizing, and evaluating high school and adult education programs. JEWELL

EOE 426 Methods of Teaching Agriculture. *Prq: Jr. standing. 3(2 2) F.* Discussion and practice in planning and presenting instruction in agriculture in formal and informal settings. Focus on principles and application of approaches to teaching and organizing instruction, motivating students, developing instructional objectives, selecting and using teaching techniques, evaluating instruction, and managing classroom and laboratory instruction. FLOWERS

EOE 427 Student Teaching in Agriculture. *Prqs: EOE 426, admission to professional semester. Coreqs: EOE 424, EOE 492. 8(2 15) S.* Skills and techniques involved in teaching vocational agriculture through practice in a public school setting with concurrent on-campus seminars. FLOWERS

EOE 433 Health Occupations Specialty Practicum. *Prq: Current credential in a recognized health discipline. 3-6 Arranged.* Provides certified health professionals an opportunity to acquire new content and depth in their particular health discipline. The requirements may be fulfilled by a combination of advanced course work related to the specialty and through individually designed practicums. The practicum will be arranged in an appropriate health care environment with selected and qualified preceptors.

EOE 434 Clinical Supervision in Health Occupations. *Prq: six hours. 3(3-0) S, Alt. yrs.* Supervisory techniques for health care professionals in initial levels of administrative positions. Internal and external factors affecting staffing and supervision process. Organization of the supervisory process. Government and labor relations in the health industry. AKROYD

EOE 436 Evaluative Skills in Teaching Health Occupations. *Prq: EOE 336. 3(3-0) S, Alt. yrs.* Program and process evaluation in health care curriculum, instruction, learning and clinical performance. Analysis of existing instruments designs for clinical evaluation with respect to validity and reliability. Development of instruments to evaluate clinical performance, construction of test items, and health care program effectiveness. AKROYD

EOE 437 Health Occupations Teaching Practicum. *3-8 F, S.* Practical teaching experience in health occupations. Certification majors complete 15 weeks of student teaching in secondary programs (8 credit hours). Non-certification majors teach in a hospital, community college, technical institute, private health industry, or other health care setting.

EOE 444 Administration of Marketing Education. *Prq: EOE 241 and admission to teacher education candidacy. 3(3 0) F, Alt. yrs.* The theory and skills necessary to plan, administer, and evaluate effective programs in the marketing education classroom. Student teachers spend ten weeks full-time in a public school: observing, teaching, and participating in the total school program. O'BRIEN

EOE 447 Student Teaching in Marketing Education. *Prq: Admission to professional semester; Coreq: EOE 494. 8(2 15) S.* Provides prospective teachers the opportunity to develop the skills and techniques required in the marketing education classroom. Student teachers spend ten weeks full-time in a public school: observing, teaching, and participating in the total school program. O'BRIEN

EOE 452 Lab Planning in Technology Education. *Prq: Admission to professional semester; Coreq: EOE 457 and 495. 3(1-4) S.* Knowledge and experience about laboratory planning are provided. Physical layout, selection, specification, and cost of equipment; the safe operation, repair and maintenance of both power and hand tools; specification of expendable supplies, estimating, and ordering.

EOE 456 Curriculum and Methods in Technology Education. *Prq: Technology Education majors only. 3(2 2) F.* Methods of teaching technology education. Emphasis on curriculum development, instructional methods, laboratory instruction, meeting the needs of special populations, and management of student organizations.

EOE 457 Student Teaching in Technology Education. *Prq: Admission to professional semester; Coreqs: EOE 452 and EOE 495.* 3 & 8 S. Students participate in off-campus student teaching in selected public schools, acquiring competencies for teaching industrial arts and familiarity with the total context in which the Technology Education program occurs.

WENIG

EOE 492 Senior Seminar in Agricultural Education. *Admission to professional semester.* 1 & 3 S. Analysis of opportunities and problems facing educational leaders in agriculture with emphasis upon current problems.

JEWELL

EOE 494 Senior Seminar in Marketing Education. *Prq: Admission to professional semester.* 3(3-0) S. Marketing Education majors analyze and discuss problems and successes experienced while student teaching in the public schools.

O'BRIEN

EOE 495 Senior Seminar in Technology Education. *Prq: Junior standing in ED and consent of the department.* 1 & 3. F.S. An in-depth investigation of a topic or a set of problems and or issues in Technology Education.

EOE 498 Special Topics in Education. *Prq: Junior or senior standing and consent of instructor.* 1 & 3. Individual or group study of special topics in professional education. The topic and mode of study are determined by the faculty member after discussion with the student.

FOREIGN LANGUAGES AND LITERATURES

(See also GRK Greek and LAT Latin.)

Note: Courses conducted in the target language, except where otherwise stated.

Note: Students with previous knowledge of French, German, Latin, or Spanish must take the placement test upon entering the University. They will be given advanced standing and receive credit according to their score, as follows.

Students completing with a C or better any course in which they are placed beyond the 101 level will receive credit for prerequisite courses to a maximum of 6 hours. Students who place beyond the requirement in their curriculum and choose not to take a foreign language course will have satisfied the foreign languages requirement but will not receive hour credit. Students transferring college credits should enroll at the level for which they have met the prerequisite.

Native speakers do not receive credit for lower division courses (100 and 200 levels) in their mother tongue.

FL101 Elementary Language I. *Prq: Consent of coordinator.* 3(3-0). Self instructional study of a foreign language, not otherwise taught in the department. Admission by interview with coordinator before registering. First of a sequence of four courses.

FL 102 Elementary Language II. *Prq: Consent of coordinator.* 3(3-0). Self instructional study of a foreign language, not otherwise taught in the department. Admission by interview with coordinator before registering. Second of a sequence of four courses.

FL 201 Intermediate Language I. *Prq: Consent of coordinator.* 3(3-0). Self-instructional study of a foreign language, not otherwise taught in the department. Admission by interview with coordinator before registering. Third of a sequence of four courses.

FL 202 Intermediate Language II. *Prq: Consent of coordinator.* 3(3-0). Self-instructional study of a foreign language, not otherwise taught in the department. Admission by interview with coordinator before registering. Fourth of a sequence of four courses.

FL(ENG)221 Literature of the Western World I. *Credit will not be given for both ENG (FL) 221 and ENG 346.* 3(3-0) F. Readings from English translations of Biblical, Classical, Medieval, and Early Renaissance literature, including works by such authors as Homer, Plato, Virgil, Ovid, St. Paul, St. Augustine, Marie de France, and Dante.

FL (ENG) 222 Literature of the Western World II. *Credit will not be given for both ENG (FL) 222 and ENG 347. 3(3-0) S.* Readings from English translations of Renaissance, Neo Classical, Romantic, and Early Modern literature, emphasizing the cultures of continental Europe from the Renaissance to 1900, and including such authors as Petrarch, Erasmus, Rabelais, Machiavelli, Shakespeare, Moliere, Voltaire, Rousseau, Goethe, Flaubert, Tolstoy.

FL (ENG) 223 Contemporary World Literature I. *Preq: ENG 112. 3(3-0) F.* Twentieth century literature of some of the following cultures: Russian, Eastern European, Western European, Latin American, Canadian, Australian.

FL (ENG) 224 Contemporary World Literature II. *Preq: ENG 112. 3(3-0) S.* Twentieth century literature of some of the following cultures: Asian, Arabian, African, Caribbean, Native-American.

FL 295 Special Topics in Foreign Languages and/or Literatures. *Preq: Consent of department. 3(3-0).* A special projects course on topics to be determined as needed in the departmental program.

FL 298 Independent Study in Foreign Language or Literature. *Preq: Consent of department. 1-6.* Individualized study in a foreign language or literature. Topic, mode of study and credit hours to be determined in consultation with the faculty member supervising work.

FL (ENG) 325 Linguistic Awareness. *3(3-0) S.* Basic issues in the study of language; linguistic terminology and categories; grammatical traditions and topics such as prescriptivism and descriptivism, standard and non-standard, orality and literacy; language acquisition and awareness; language aesthetics and ethics.

FL 350 Modern European Literary Criticism. *Preq: 6 hours of any 300 level literature courses. 3(3-0).* Study of theoretical and philosophical foundations and applied methods in major currents of modern European literary criticism. Includes structuralism, poststructuralism, feminism, and psychoanalytical and ideological criticism. Examination of critical works and application to literary texts. Course taught in English.

FL (ENG) 394 Studies in World Literature. *Preq: ENG 111 and 112 or 112H. 3(3-0) F,S.* Study of a subject in world literature; for example, African literature, Asian literature, Hispanic literature, East European literature, comedy, the epic, the lyric, autobiography, the Faust legend, or Metamorphosis. Subjects vary according to availability of faculty. Readings in English translation.

FL 395 Study Abroad Programs. *Preq: FL 202. 1-3.* Specific category of courses involving language and or culture taught in foreign countries through the Department Study Abroad Program.

FL 495 Special Topics in Foreign Languages and Literatures. *Preq: Consent of department. 3(3-0).* A concentrated study of a special period, author or genre to be determined as needed in the departmental program.

FL 498 Independent Study in Foreign Language or Literature. *Preq: Consent of department. 1-6.* Individualized study of a foreign language or literature. Topic, mode of study, and credit hours to be determined in consultation with the faculty member supervising work.

CHINESE LANGUAGE AND LITERATURE

FLC 101 Elementary Chinese I. *3(3-0) F.* Introduction to Modern Standard Chinese. Emphasis on speaking and listening with an introduction to reading, writing and Chinese culture.

FLC 102 Elementary Chinese II. *Preq: FLC 101. 3(3-0) S.* Continuation of basic skills. Emphasis on speaking and listening with some reading, writing and Chinese culture.

FLC 105 Intensive Elementary Chinese. 6(6 0). Intensive introduction to modern standard Chinese. Emphasis on speaking and listening with an introduction to reading, writing and Chinese culture.

FLC 201 Intermediate Chinese I. *Prq: FLC 102. 3(3 0) F.* Continuation of basic skills. Greater emphasis on reading, writing and Chinese cultural traditions.

FLC 202 Intermediate Chinese II. *Prq: FLC 201. 3(3 0) S.* Continuation of basic skills. Focus on reading, writing, Chinese cultural traditions and patterns of behavior.

FLC 301 Intermediate Chinese III. *Prq: FLC 202. 3(3 0) F.* Last of the foundation courses in Chinese. Continued practice in speaking and understanding Chinese with new emphasis on writing and on the reading of cultural and literary texts.

FLC 302 Intermediate Chinese IV. *Prq: FLC 301. 3(3 0) S.* Continued practice in speaking and understanding Chinese with greater emphasis on reading and writing. Continued study of cultural and literary texts.

ENGLISH FOR INTERNATIONAL STUDENTS

NOTE: Undergraduate students in the following colleges do not receive free elective credit for the successful completion of Foreign Language English courses. (FLE 101, 102, 103, 104); School of Design, College of Education and Psychology, College of Engineering, College of Physical and Mathematical Science, and College of Textiles. Credits for the FLE courses received by students in those colleges will be recorded on grade reports and transcripts and will be used in GPA calculations, but these credits will not count as part of the hours required for graduation. Students in the College of Agriculture and Life Sciences, the College of Forest Resources, the College of Humanities and Social Sciences, and the College of Management receive free elective credit towards graduation for successful completion of any of the FLE courses.

FLE 101 Foreign Language English: Grammar Review. *Prq: Scores between 550 and 590 on the TOEFL; Coreq: Michigan Test of English Language Proficiency and Michigan Test of Aural Comprehension. Open only to non-native speakers of English. 3(3-0) F,S.* Review of English grammar with emphasis on word order patterns, idioms, and function words of spoken American English; oral drill on statement and question patterns in all tenses; and practice in constructing original patterns. Language laboratory practice required.

FLE 102 Foreign Language English: Writing. *Prq: Scores between 550 and 590 on the TOEFL; Coreq: Michigan Test of English Language Proficiency and Michigan Test of Aural Comprehension. Open only to non-native speakers of English. 3(3 0) F,S.* Practice in writing sentences, paragraphs, summaries, outlines, and compositions. Drills on mechanics: spelling, punctuation, capitalization, and apostrophes. Exercises on use of transitional words, quotation and subordination to indicate relationships. Analysis and imitation of well-written paragraphs to learn logical organization, coherence, and unity. Formal compositions written in class and informal journals written outside class.

FLE 103 Foreign Language English: Oral English. *Prq: Scores between 550 and 590 on the TOEFL; Coreq: Michigan Test of English Language Proficiency and Michigan Test of Aural Comprehension. Open only to non-native speakers of English. 3(3 0) F,S.* Designed for students who need additional oral English practice in order to comprehend spoken English and be understood by native speakers. Emphasis on correct pronunciation and intonation and the use of colloquial expressions and speech patterns. Aural comprehension exercises, oral drills to practice idiomatic English and functional (survival) vocabulary, role playing, class discussions and films. Language laboratory practice required.

FLE 104 Foreign Language English: Reading Improvement. *Prq: Scores between 550 and 590 on the TOEFL; Coreq: Michigan Test of English Language Proficiency and Michigan Test of Aural Comprehension. Open only to non-native speakers of English. 1(0-3) S.* Designed for students who need to improve reading speed and comprehension in order to read efficiently in other courses. Concept of class as a reading lab with timed drills and

materials to give students practice in responding rapidly and accurately to increasingly longer units of reading matter. Technique of scanning, dictionary and vocabulary-building exercises.

FRENCH LANGUAGE AND LITERATURE

FLF 101 Elementary French I. *3(3 0) F,S,Sum.* First in a four-course sequence to develop language skills. Oral and written practice in classroom and language laboratory. Readings in French culture and civilization.

FLF 102 Elementary French II. *Preq: FLF 101. 3(3 0) F,S,Sum.* Continuation of FLF 101 with intensive practice in spoken French. Readings in French culture and civilization.

FLF 105 Intensive Elementary French. *6(6-0).* An intensive course aimed at developing a balanced foundation in listening, speaking, reading, and writing French. Equivalent to FLF 101 plus FLF 102.

FLF 201 Intermediate French I. *Preq: FLF 102. 3(3 0) F,S,Sum.* Third of four consecutive courses to develop skills of speaking, listening, reading and writing. Readings and discussions of French culture, civilization and literature.

FLF 202 Intermediate French II. *Preq: FLF 201. 3(3 0) F,S,Sum.* Last of four sequential language courses. Increased emphasis on reading and writing. Readings in the literature, culture, and civilization of France and the francophone world.

FLF 208 Intermediate French Conversation. *Preq: FLF 201. 3(3-0) F,S.* Intensive practice in speaking and understanding French through role playing, debates, interviews, and use of audio-visual materials.

FLF 301 Survey of French Literature to 1800. *Preq: Any of the following: FLF 308, 310, 311 or 315. 3(3 0) F.* Literature of the French Middle Ages, French Renaissance, Classicism and Enlightenment; special attention to genre development. Readings of representative works with analytical and critical emphasis.

FLF 302 Survey of French Literature Since 1800. *Preq: Any of the following: FLF 301, 308, 310, 311, 315. 3(3 0) S.* French Romanticism, Realism, Symbolism, Surrealism, Existentialism, and modern literary experimentation. Readings of representative works with analytical and critical emphasis.

FLF 307 Technical and Commercial French. *Preq: FLF 202. 3(3 0) F. Alt. yrs.* Conversational and written French with emphasis on technical and commercial materials.

FLF 308 French Conversation and Reading. *Preq: FLF 202. 3(3-0) S.* Intensive practice in speaking and reading French. Drills and conversation emphasizing practical language and idiomatic expressions.

FLF 309 French Phonetics and Pronunciation. *Preq: FLF 202. 3(3-0) F.* A study of the production of the sounds of Standard French with the aim of improving pronunciation and fluency. Extensive oral practice in major problem areas.

FLF 310 French Syntax and Composition. *Preq: FLF 202. 3(3 0) F.* A thorough study of the more advanced aspects of the grammar of the French language, with extensive practice in writing.

FLF 311 Methods and Techniques in French Translation. *Preq: FLF 202. 3(3 0) F. Alt. yrs.* Methods and techniques in translation with an emphasis on writing skills.

FLF 315 French Civilization and Culture. *Preq: FLF 202. 3(3 0) S.* French civilization and culture, through reading, discussion and presentation of the social, economic and political structures of France, along with its geography, history, music and art. Taught in French.

FLF 316 French Lyric Poetry. *Preq: FLF 202. 3(3 0) S. Alt. yrs.* Development of the French lyric genre from the origins to the present, including the rules and practices of French versification.

FLF 318 The Heritage of French Cinema. *Preq: FLF 202. 3(3-0) S.* Survey of the major contributions of French cinema from its origins to the present. Attention to film as an artistic medium and to the cinematic representation of French history and culture. Reading, discussion, and viewing of films including *Un Chien Andalou*, *La Passion de Jeanne d'Arc*, *Le Retour de Martin Guerre*, *La Marseillaise*, *Les 400 Coups*, and *Diva*.

FLF 323 The French Novel of the Twentieth Century. *Preq: FLF 202. 3(3-0) F.* Survey of the 20th century French novel. Works of Gide, Proust, Mauriac, Malraux, Sartre and Camus and representative novels of surrealism, existentialism, and the "new novel".

FLF 324 Contemporary French Theater. *Preq: FLF 202. 3(3-0).* Representative playwrights of twentieth century France, including Giraudoux, Anouilh, Sartre, Beckett, Ionesco, and Genet.

FLF 352 Francophone Culture of West Africa and the Caribbean. *Preq: FLF 202. 3(3-0).* Literary and cultural traditions of French speaking West Africa and the Caribbean. Taught in French.

FLF 393 Francophone Culture of Ghana and Togo. *Preq: FLF 202. 1-3. Will be taught in Topo through the NCSU Summer Study Abroad Program.* An examination of the artistic, cultural and political life of modern Ghana and Togo.

FLF 414 Masterpieces of French Prose. *Preq: FLF 202. 3(3-0).* French Prose from the Renaissance to 1900.

FLF 415 French Theater To 1900. *Preq: FLF 202. 3(3-0) S, Alt. yrs.* Reading and discussion of representative French plays, including a study of tragedy, comedy, farce, and drama. Authors include Corneille, Racine, Moliere, Lesage, Marivaux, Sedaine, Beaumarchais and Musset.

FLF 492 Seminar in French Studies. *Preq: Junior standing and consent of department. 3(3-0) S.* A small group study of a topic in literature resulting in either a substantial essay or series of essays by each student. Topics vary each semester.

GRADUATE CERTIFICATION ONLY

FLF 401 French for Graduate Students. *Preq: Graduate standing. Not open to undergraduates. 3(3-0) F.* Basic French grammar, with special attention to characteristics of formal expository style, and illustrative readings. Study of extracts from scholarly publications in the students' areas of research. Graduate language certification granted on satisfactory completion of the course.

GERMAN LANGUAGE AND LITERATURE

FLG 101 Elementary German I. *3(3-0) F,S,Sum.* The first in a four-course sequence intended to teach the student to understand, speak, read and write everyday German. Emphasis on speaking and understanding with additional reading of cultural materials. Intensive practice in the language lab.

FLG 102 Elementary German II. *Preq: FLG 101. 3(3-0) F,S,Sum.* Strong emphasis continued on understanding and speaking German, but increasing attention to syntax, vocabulary building, and awareness of cultural heritage of the German speaking countries.

FLG 201 Intermediate German I. *Preq: FLG 102. 3(3-0) F,S,Sum.* The third of four consecutive courses in German. Intensive conversational drill to build the students' ability to understand and speak everyday German. Supplementary readings in German literature and culture.

FLG 202 Intermediate German II. *Preq: FLG 201. 3(3-0) F,S.* Last of four sequential courses in German. Continued use of everyday spoken German but greater emphasis on reading and writing. Additional readings in German literature and culture.

FLG 208 Intermediate German Conversation. *Preq: FLG 201. 3(3-0) F, S.* Intensive practice in speaking and understanding German through role playing, debates, interviews and use of audio-visual materials.

FLG 307 Technical and Commercial German. *Preq: FLG 202. 3(3 0) F, Alt. yrs.* Conversational and written German with emphasis on technical and commercial materials.

FLG 309 Advanced German Conversation and Phonetics. *Preq: FLG 202. 3(3 0).* Intensive conversational practice in class and language laboratory based on current topics, and a study of sound production and linguistic terminology. Discussions of German culture and civilization. Attention to cultural factors essential to effective communication. Oral reports by students.

FLG 310 Advanced German Syntax and Composition. *Preq: FLG 202. 3(3 0).* Advanced aspects of German syntax and writing styles. Assignments include paraphrasing and summarizing authentic German texts and writing compositions.

FLG 315 Germanic Civilization and Culture. *Preq: FLG 202. 3(3 0).* Culture and civilization of the German-speaking countries. Analysis of the social, economic and political structures of Germany, Austria, and Switzerland. Lectures, reports, conversation. Taught in German.

FLG 316 German Lyric Poetry. *Preq: FLG 202. 3(3 0) Every 3rd yr.* Historical and interpretative study of the German lyric from the fifteenth to the twentieth century.

FLG 323 Twentieth Century German Literature. *Preq: FLG 202. 3(3-0).* Twentieth century literature from German-speaking countries. Readings of Mann, Kafka, Rilke, Hesse, Dürrenmatt, Frisch, Grass, and a variety of poets.

GRADUATE CERTIFICATION ONLY

FLG 401 German for Graduate Students. *Preq: Graduate standing; Not open to under graduates. 3(3-0) F.* Basic German grammar, with special attention to characteristics of formal expository style, and illustrative readings. Study of extracts from scholarly publications in the students' areas of research. Graduate language certification granted on satisfactory completion of the course.

HEBREW LANGUAGE AND LITERATURE

FLH (REL) 101 Elementary Biblical Hebrew I. *3(3 0).* (See Religion)

FLH (REL) 102 Elementary Biblical Hebrew II. *Preq: REL (FLH) 101. 3(3 0).* (See Religion)

FLH (REL) 201 Intermediate Biblical Hebrew I. *Preq: REL (FLH) 102. 3(3 0).* (See Religion)

FLH (REL) 202 Intermediate Biblical Hebrew II. *Preq: REL (FLH) 201. 3(3 0).* (See Religion)

ITALIAN LANGUAGE AND LITERATURE

FLI 101 Elementary Italian I. *3(3 0) F.* Begins the development of a balanced foundation in all four language skills. Concentrates on listening and speaking, emphasizing idiomatic Italian. Short readings in Italian culture and civilization. Class and laboratory practice, written homework.

FLI 102 Elementary Italian II. *Preq: FLI 101. 3(3 0) S.* Continuation of FLI 101 with emphasis on acquisition of oral skills through class practice and use of audio aids. Readings in Italian culture, civilization and literature.

FLI 201 Intermediate Italian I. *Preq: FLI 102. 3(3-0) F.* Third of four consecutive courses to develop skills of speaking, listening, reading and writing. Readings and discussion of Italian culture, civilization and literature.

FLI 202 Intermediate Italian II. *Preq: FLI 201. 3(3-0) S.* Last of four sequential language courses. Increased emphasis on reading and writing. Readings in the literature, culture, and civilization of Italy.

FLI 208 Intermediate Italian Conversation. *Coreq: FLI 201. 3(3 0).* Intensive practice in speaking and understanding Italian through role playing, discussion, interviews, and use of audio visual materials.

FLI 308 Italian Reading and Conversation. *Preq: FLI 201. 3(3 0).* Advanced readings and intensive conversational practice in Italian for students beyond the intermediate level.

JAPANESE LANGUAGE AND LITERATURE

FLJ 101 Elementary Japanese I. *3(3 0) F.* Introduction to standard, formal Japanese. Emphasis on speaking and listening skills. Exposure to Japanese culture, reading, and writing.

FLJ 102 Elementary Japanese II. *Preq: FLJ 101. 3(3 0) S.* Continuation of basic skills. Emphasis on speaking and listening skills; inclusion of Japanese cultural factors in communication. Some reading and writing.

FLJ 103 Elementary Japanese I Conversation. *Coreq: FLJ 101. 1(1 0) F.* Supplements conversational practice in FLJ 101. Students are encouraged to use their speaking skills in a variety of situations. Special attention is given to correcting and improving pronunciation and intonation.

FLJ 104 Elementary Japanese II Conversation. *Preq: FLJ 101; Coreq: FLJ 102. 1(1-0) S.* Supplements conversational practice in FLJ 102. Students are encouraged to use their speaking skills in a variety of situations. Special attention is given to correcting and improving pronunciation and intonation.

FLJ 105 Intensive Elementary Japanese. *6(6 0).* An intensive introduction to standard, formal Japanese. Emphasis is on speaking and listening skills. Some reading and writing. Combines FLJ 101 and 102.

FLJ 201 Intermediate Japanese I. *Preq: FLJ 102 or FLJ 105. 3(3 0) F.* Continuation of basic skills. Greater emphasis on reading and writing. More exposure to Japanese cultural traditions.

FLJ 202 Intermediate Japanese II. *Preq: FLJ 201. 3(3 0) S.* Continuation of the learning of the basic skills. Emphasis on reading and writing as well as on spoken Japanese and on cultural patterns of behavior.

FLJ 203 Intermediate Japanese Conversation. *Preq: FLJ 102; Coreq: FLJ 201, FLJ 202 or FLJ 301. May be repeated to a maximum of three credit hours. 1(1-0) F.S.* Practice in spoken Japanese through use of the language in a variety of situations. Increase vocabulary and develop fluency and ease in the structural patterns of the language.

FLJ 204 Intermediate Japanese II Conversation. *Coreq: FLJ 202. 1(1 0) S.* Supplemental intermediate conversational practice. Drills and situational exercises to build oral proficiency with patterns introduced in FLJ 202.

FLJ 205 Intensive Intermediate Japanese. *Preq: FLJ 105 or FLJ 102. 6(6 0).* An intensive study of standard, formal Japanese on the intermediate level with increased emphasis on reading and writing.

FLJ 301 Intermediate Japanese III. *Preq: FLJ 202 or FLJ 205. 3(3-0) F.* Last of the foundation courses in Japanese. Continued use of spoken Japanese but greater emphasis on reading and writing, including further exposure to cultural traditions.

FLJ 302 Intermediate Japanese IV. *Preq: FLJ 301. 3(3-0) S.* Review of basic grammar and preparation for advanced reading and composition. Some advanced conversation, with attention to cultural values.

FLJ 401 Advanced Japanese I. *Preq: FLJ 302. 3(3-0) F.* A thorough review of the more advanced aspects of the grammar of the Japanese language, with extensive practice in reading and writing and further sensitization to Japanese cultural values.

FLJ 402 Advanced Japanese II. *Preq: FLJ 401. 3(3-0) S.* Elaboration of grammatical forms learned in the previous courses with applications in reading and writing, combined with more sophisticated vocabulary and idioms and attention to cultural background and tradition.

FLJ 411 Readings in Modern Japanese I. *Preq: FLJ 402. 3(3 0) F.* Reading of selected articles in modern Japanese chosen from a list by the students to reflect their individual interests. Readings encompassing a broad range of issues in Japanese culture and society. Emphasis on both accurate comprehension of content and retention of the most frequently encountered Chinese characters (kanji).

FLJ 412 Readings in Modern Japanese II. *Preq: FLJ 411. 3(3 0) S.* Readings of selected articles in modern Japanese which reflect current issues in Japanese society and culture. Includes newspapers and both popular and specialized magazines. Emphasis on literary and journalistic idioms as well as characters.

SWAHILI (KISWAHILI) LANGUAGE AND LITERATURE

FLK 101 Elementary Swahili I. *3(3-0) F, Alt. yrs.* First in a four-course sequence to develop language skills in Swahili (Kiswahili). Oral and written practice. Readings in African culture and civilization.

FLK 102 Elementary Swahili II. *Preq: FLK 101. 3(3-0) S, Alt. yrs.* Second in a four-course sequence to develop language skills in Swahili (Kiswahili). Oral and written practice. Readings in African culture and civilization.

FLK 201 Intermediate Swahili I. *Preq: FLK 102. 3(3 0) F, Alt. yrs.* Third in a four-course sequence to develop language skills in Swahili (Kiswahili). Oral and written practice. Readings in African culture and civilizations.

FLK 202 Intermediate Swahili II. *Preq: FLK 202. 3(3 0) S, Alt. yrs.* Fourth in a four-course sequence to develop language skills in Swahili (Kiswahili). Oral and written practice. Readings in African culture and civilization.

PORTUGUESE LANGUAGE AND LITERATURE

FLP 101 Elementary Portuguese I. *3(3 0).* Introduction to the fundamentals of Brazilian Portuguese: pronunciation, comprehension, and spoken syntax and grammar.

FLP 102 Elementary Portuguese II. *Preq: FLP 101. 3(3 0).* Continuation of the essentials of Brazilian Portuguese. Further stress on pronunciation and comprehension and introduction of reading and writing skills.

RUSSIAN LANGUAGE AND LITERATURE

FLR 101 Elementary Russian I. *3(3-0) F.* First in a four-course sequence to develop language skills in Russian. Oral and written practice in the classroom and language laboratory and attention to Russian cultural heritage.

FLR 102 Elementary Russian II. *Preq: FLR 101. 3(3 0) S.* Emphasis on acquisition of basic oral skills, with complementary reading and writing exercises and attention to Russian cultural heritage.

FLR 201 Intermediate Russian I. *Prereq: FLR 102, 3(3-0) F.* Learning of basic Russian language skills is continued. More emphasis given to writing and essential conversational practice. Intermediate level readings in Russian literature and culture. Class and laboratory practice; written assignments.

FLR 202 Intermediate Russian II. *Prereq: FLR 201, 3(3-0) S.* Study of more advanced aspects of Russian syntax through reading of prose of Russian writers. Continued attention to conversational practice and vocabulary building.

FLR 303 Russian Literature in Translation: The Nineteenth Century. *3(3-0) S, Alt. yrs.* A study of selected plays, short stories and novels of the great Russian writers of the nineteenth century: Pushkin, Lermontov, Gogol, Goncharov, Turgenev, Dostoevsky, Saltykov Shchedrin, Leskov, Tolstoy and Chekhov. Examinations of peculiarly Russian as well as the universal aspects of this literature. All readings, lectures and discussions in English.

FLR 304 Russian Literature in Translation: The Twentieth Century. *3(3-0) S, Alt. yrs.* Selected texts by major Russian writers of the twentieth century from the eve of the Revolution to Perestroika. Major topics in Russian cultural history. Emphasis on interpretation. All readings in English.

SPANISH LANGUAGE AND LITERATURE

FLS 101 Elementary Spanish I. *3(3-0) F,S,Sum.* Concentrates on listening and speaking, and begins the development of a balanced foundation in all Spanish language skills. Idiomatic, everyday Spanish and cultural awareness are emphasized. Class practice, laboratory and written homework.

FLS 102 Elementary Spanish II. *Prereq: FLS 101, 3(3-0) F,S,Sum.* Expands use of Spanish through past tenses, regular and irregular, and various morphological and syntactical aspects. Emphasis on oral skills and increased cultural awareness. Written work and laboratory practice assigned daily.

FLS 105 Intensive Elementary Spanish. *6(6-0).* An intensive course aimed at developing a balanced foundation in listening, speaking, reading, and writing Spanish. Equivalent to FLS 101 plus FLS 102.

FLS 201 Intermediate Spanish I. *Prereq: FLS 102 or 105, 3(3-0) F,S,Sum.* The third of four consecutive Spanish courses. As with 101 and 102, its aim is mainly to teach idiomatic, spoken Spanish. Reading and writing skills receive greater attention than previously, as does the cultural heritage of the Spanish speaking peoples. Class practice, laboratory and written assignments.

FLS 202 Intermediate Spanish II. *Prereq: FLS 201, 3(3-0) F,S,Sum.* Last of four sequential courses, completing the learning of the foundations of the Spanish language. Writing receives greater attention, as does the cultural heritage of Spanish speaking peoples.

FLS 208 Intermediate Spanish Conversation. *Coreq: FLS 201, 3(3-0) F,S.* Intensive practice in speaking and understanding Spanish through role playing, discussion, interviews and use of audio-visual materials.

FLS 300 Introduction to Hispanic Literatures. *Prereq: FLS 202, 3(3-0) F,S.* An introduction to the major literary genres and movements in Spanish and Latin American literatures. Lectures, discussions, films and written assignments.

FLS 301 Survey of Spanish Literature Through The Golden Age. *Prereq: FLS 202, 3(3-0) F.* Literature of Spain and Spanish America from the Middle Ages to the beginning of the eighteenth century.

FLS 302 Survey of Spanish Literature: 1700 to Present. *Prereq: FLS 202, 3(3-0) S.* Introduction to Spanish Neoclassicism, Romanticism, Realism, and twentieth-century literature. Special attention to the quest for new values in contemporary literature.

FLS 304 Modern Latin American Literature. *Preq: FLS 202, 3(3-0) S.* A survey of modern Latin American literature from Modernism to the present.

FLS 307 Business Spanish. *Preq: FLS 202, 3(3 0) F.* Business Spanish vocabulary and terminology. Emphasis on everyday spoken and written Spanish. Readings and discussions of business topics. Cross cultural considerations relative to international business operations.

FLS 308 Spanish Conversation and Reading. *Preq: FLS 202, 3(3 0) S.* Intensive practice in speaking and reading Spanish. Drills and conversation emphasizing practical language and idiomatic expressions.

FLS 309 Spanish Phonetics and Advanced Conversation. *Preq: FLS 202, 3(3 0) F.* The production of the sounds of standard Spanish with the aim of improving pronunciation, fluency, and skill in communication. Extensive oral practice in phonetics and conversation.

FLS 310 Advanced Spanish Grammar. *Preq: FLS 202, 3(3 0) S.* Advanced aspects of Spanish grammar, with extensive practice in writing. Lectures, discussions and compositions incorporate topics relevant to Hispanic culture and civilization.

FLS 311 Advanced Spanish Composition. *Preq: FLS 202, 3(3 0) F.* An intensive course in the theory and practice of Spanish composition. Lectures, discussions and weekly writing assignments are required.

FLS 315 Culture and Civilization of the Iberian Peninsula. *Preq: FLS 202, 3(3-0) F.* The Iberian Peninsula as a crossroad of civilizations from neolithic times to the present. The emergence of Spain and Portugal as nations, the rise and fall of their overseas empires, and their contemporary civilizations.

FLS 316 The Culture and Civilization of Latin America. *Preq: FLS 202, 3(3 0) S.* Survey of the cultural traditions of Latin America including Brazil. The major pre-Columbian civilizations, Spanish and Portuguese colonialism, the emergence of the modern nations. Films and recordings supplement readings and discussions.

FLS 323 Contemporary Spanish Literature. *Preq: FLS 202, 3(3 0) S. Alt. yrs.* Selected works of Spanish fiction, essays and poetry in the twentieth century. Special attention is given to the generations of 1898 and 1927 and to post Civil War writers.

FLS 400 Methods and Techniques in Spanish Translation and Interpretation. *Preq: FLS 202, 3(3 0) S.* Study and practical application of theory, methods and techniques of translation based on materials relevant to various fields and professions.

FLS 403 Spanish Prose Fiction to 1900. *Preq: Consent of department, 3(3 0) F. Alt. yrs.* Spanish novel and short story from *La Celestina* through the novels of Galdós. Major emphasis is given to the picaresque novel, *Don Quijote*, eighteenth century didactic prose, and nineteenth century Realism.

FLS 404 Spanish Drama. *Preq: Junior standing, 3(3 0) F. Alt. yrs.* Spanish drama from its beginning to the present. Special emphasis on Golden Age (16th and 17th centuries) and contemporary theater.

FLS 492 Seminar in Hispanic Studies. *Preq: Junior standing and consent of department, 3(3-0) S.* Advanced seminar on a specific area of Hispanic studies (topics vary), leading to a major term paper and or a series of essays by the student.

GRADUATE CERTIFICATION ONLY

FLS 401 Spanish for Graduate Students. *Preq: Graduate standing; not open to under graduates, 3(3 0) F.* Basic Spanish grammar, with special attention to characteristics of formal expository style, and illustrative readings. Study of extracts from scholarly publications in the students' areas of research. Graduate language certification granted on satisfactory completion of the course.

FORESTRY

FOR 110 Introduction to Forestry. *2(1-3) F.* Overview of the history and policies of forestry, the basis of forest management, the impact of forestry on nature and society, and the opportunities of a career in forestry. COOPER

FOR 204 Silviculture. *Preqs: Junior standing in FOR; meet summer camp eligibility standards. Coreq: FOR 261. 2(0-6) Sum (Summer Camp).* Growth dynamics of forest trees and stands coupled with an overview of the practice of silviculture; emphasis on understanding and integrating previously learned ecological principles. Observation and practice of cultural measures commonly employed in southern forest types. JERVIS

FOR 212 Dendrology. *4(2-4) F.* Identification and basic biology of eastern woody plants with studies of their classification, characteristics, and habitats. Consideration of important northern and western trees. Field identification and trips to natural forest communities. Required Saturday field trips. BRAHAM

FOR 252 Introduction to Forest Science. *Not open to forestry majors. 3(2-3) S.* Integration of biological principles into studies of tree growth, reproduction, establishment, survival, and disturbance. Discussions of regional silviculture, and of effects of humans on forest ecosystems. Instruction in forest sampling and tree identification. Many laboratories meet outdoors. BRAHAM, JERVIS

FOR 261 Forest Communities. *Preqs: Junior standing in FOR; meet summer camp eligibility standards. 2(0-6) Sum (Summer Camp).* Studies of the occurrence, distribution, and species composition of forest communities. Emphasis on southeastern North America, but consideration of and comparison to northeastern and northern North America. Field trips to representative types in the Coastal Plain, Piedmont, and Mountains. BRAHAM

FOR 264 Forest Pest Management. *Preqs: Junior standing in FOR; meet summer camp eligibility standards. 1(0-3) Sum (Summer Camp).* Basic concepts of pest injury to trees. Recognition of the important insects and diseases of forest trees in the southeast and the damage caused by them. Principles of silvicultural control of pests and the proper selection and use of pesticides. GRAND

FOR 265 Fire Management. *Preqs: Junior standing in FOR; meet summer camp eligibility standards. 1(0-3) Sum (Summer Camp).* Effects of wildfire and prescribed fire on forest ecosystem components and processes; fire behavior and the ecosystem and meteorologic factors that affect it; silvicultural uses of fire; organization, equipment, and tactics for wildfire suppression; fire suppression exercises on the North Carolina Division of Forest Resources' Forest Fire Simulator. GREGORY

FOR 274 Mapping and Mensuration. *Preqs: Junior standing in FOR; meet summer camp eligibility standards. 4(1-2) Sum (Summer Camp).* Procedures and instruments for measuring tree parameters, stand density and site index. Determination of log and tree volume and planning, conducting and summarizing a timber inventory. Basic land measurements and the mapping of boundary surveys; use of maps and deed.

FOR 303 Forest Tree Physiology. *Preqs: BS 100, CH 103, PY 211, Summer Camp; Coreq: SSC 200. 3(3-0) F.* Structure of forest trees and the patterns, processes, and regulation of growth. Processes of primary productivity and the relationship of productivity and growth to environmental factors that affect tree growth. Evolution, variation and adaptation in trees; genetic control of physiological processes. Flowering and reproduction in forest trees. HENRY

FOR 304 Theory of Silviculture. *Preq: FOR 303. 4(3-3) S.* Theory and practices involved in natural and artificial forest stand regeneration including: species growth and silvical characteristics; soil/site relationships; site evaluation; insect and disease considerations; methods of insuring desired species composition, yields and economics; diagnosis and prescription of intermediate stand treatments and harvesting methods; seedling production systems and tree improvement. Integration of other objectives with timber production. FREDERICK, ALLEN

FOR (FW) 310 Fisheries and Wildlife Inventory and Management. *Preqs: Junior standing in SFW, FOR, NRE, NRP, or SZO; FW ZO 221, 6(0 18) Sum.* (See Fisheries and Wildlife Sciences)

FOR (PP) 318 Forest Pathology. *Preq: BS 100 or equivalent. 4(3 2) S.* (See Plant Pathology)

FOR 319 Forestry Economics. *Preq: ARE 212, summer camp. 3(3 0) F.* Concepts and techniques for evaluating the profitability of long-term timber investments. Identification of the biological and market variables that affect profitability. Introduction to the income tax treatment of timber income, including financial incentives provided through the tax system. **HOLLEY**

FOR 352 Forest Measurements and Management. *Preq: Not open to forestry majors. 4(2-4) F.* Basic boundary surveying and mapping, forest inventory including tree and log measurement, plot sampling, and data analysis; timber valuation, appraisal, marketing, and taxation; forest management planning, decision-making and yield forecasting.

FOR 353 Air Photo Interpretation and Photogrammetry. *Preq: Jr. standing. 3(2 3) F.* Theory, principles, and techniques of utilizing air photos for: 1) inventory and management of renewable resources; 2) photogrammetric and engineering applications; 3) hydrologic terrain analysis; and 4) land use cover mapping. Introduction to remote sensing and use of U-2 color infrared, thermal, Skylab, and Landsat imagery in resource mapping. **KHORRAM**

FOR 374 Forest Measurement, Modeling, and Inventory. *Preqs: MA 121 or 114 or 242, FOR 274, ST 311. 3(2-3) S.* Mathematical functions for modeling tree and forest structure and dynamics, and quantifying the yield of timber and nontimber products. Procedures for planning, conducting, and analyzing forest inventories. Use of computer models to estimate growth and yield of forest stands for management decisions. **SMITH, ROISE**

FOR 401 Forest Hydrology and Watershed Management. *Preq: SSC 200. Not recommended for students below senior classification, non forestry majors should contact the instructor prior to start of class. 4(3-3) F.* The hydrologic and energy cycles and the effects of forest and associated wildland vegetation on elements of those cycles. Water movement through forest ecosystems. Effects of forestry practices on water yield, soil conservation, and water quality. Principles of watershed management for single or multiple use. **GREGORY**

FOR (FW) 404 Forest Wildlife Management. *Preq: 9 hrs Biological Sciences. 3(3-0) S.* Relationships between forest and wildlife management and the effects of silvicultural systems on wildlife. Species habitat requirements, forest wildlife management techniques, and forest wildlife policies and economics. (See Fisheries and Wildlife Sciences) **LANCIA**

FOR 405 Forest Management. *Preq: FOR 374, 319, 434. 4(2-4) F.* Fundamental principles and analytical techniques necessary in the planning, management and optimization of forest operations, formulation of objectives and constraints, yield forecasting, forest regulation, procurement, and marketing, inventory methods, and management plant preparation. Written and oral reporting are integral components of this course. **SMITH, ROISE**

FOR 406 Forest Inventory, Analysis and Planning. *Preqs: FOR 405, FOR 353, Summer Camp; ST 311. 4(0-16) S.* Independent field work in forest inventory, analysis and planning. Students design and implement a timber and nontimber inventory, analyze stand conditions and growth, and prepare a long term management plan considering management objectives subject to economic, social, and ecological constraints. Includes several field trips to public and private forestry operations which may include overnight travel. **BLANK, SMITH**

FOR 411 Forest Tree Improvement. *Preq: Junior or senior standing in forestry. 3(3-0) S.* Tree improvement as it is applied in production forestry for both conifers and hardwoods. The variation, evolution, and genetics of forest trees. Methods for selection breeding, seed production, and vegetative propagation. Studies of exotics, wood properties, and tree improvement as a forest management tool. ZOBEL

FOR 422 Consulting Forestry. *Preq: Senior standing in forestry. 3(2-4) F.* Forest land acquisition and ownership; ownership, appraisal, legal considerations, financial management and planning. Producing forest resources timber, wildlife, recreation, farm products, water, minerals, specialty products, and development. Marketing forest resources: timber, recreation, farm leases, minerals, specialty products, and developed property. Forest resources consulting: forms of organization, pricing of services, consultant client relationships (Law of Agency), professional ethics and continuing education. FRANKLIN

FOR (WPS) 423 Forest Machinery and Systems. *Preq: Junior standing in FOR, WST, or BAE. 3(2-3) F.* Applications of engineering principles to problems in the forest industry including harvesting, road layout, log transportation, woodyard and milling operations power sources; testing, rating and capabilities of forest machinery; power requirements and utilization efficiencies, effects of vehicle design parameters on stability, safety, and operation under load; traction devices and vehicle mechanics; cost analysis and systems selection. HASSAN

FOR (WPS) 434 Management Decision Making in Forestry and Wood Products. *Preqs: MA 113 and 114, 3(3-0) S.* Management science techniques and applications in forest industry. Linear programming, simulation, decision theory and inventory theory. Techniques to solve decision making problems typically encountered. ROISE, ABT

FOR 472 Renewable Resource Policy and Management. *Preq: Junior standing. 4(3-2) F.* A legal and institutional approach to renewable resource management. Historic legal principles, constitutional provisions, location and organization of concerned agencies. Illustration of policy and principles through analysis of current issues and case studies. Examples from water resource development, coastal zone management, national forest and park policy, and implementation of the National Environmental Policy Act. ADAMS, COOPER

FOR 491 Special Topics in Forestry and Related Natural Resources. *Preq: Consent of Instructor. 1-4 F,S,Sum.* Independent (or group) study or research of a forestry or related natural resources topic with a faculty supervisor of the student's choice. Also courses offered on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

FOR 511 Tree Improvement Research Techniques. *Preq: FOR 411 or GN 411. 3(1-4) S, Alt. yrs.*

FOR 512 Forest Economics. *Preq: Basic course in economics. 3(3-0) S.*

FOR (PP) 518 Advanced Forest Pathology. *Preq: PP 318 or equivalent. 3(3-1) F, Alt. yrs.*

FOR 534 Advanced Forest Management Planning. *Preq: FOR 405 or 434 or OR 501; Corq: FOR 572A. 3(3-0) S, Alt. yrs.*

FOR 540 Advanced Dendrology. *Preq: FOR 212 or BO 403. 3(2-3) S.*

FOR (ENT) 565 Advanced Forest Entomology. *Preq: ENT 301 or ENT 502 or CI. 3(2-2) S, Alt. yrs.*

FOR 571 Advanced Topics in Growth and Yield. *Preqs: FOR 374, ST 311. 3(3-0) S.*

FOR 572A, B Forest Management Policies on the Public Lands. *2(2-0) S, Alt. yrs.*

FOR 580 Soil-Machine Interactions in Forest Operations. *Preq: FOR 423. 3(3-0) F, Alt. yrs.*

FOR 583 Tropical Forestry. *3(3-0) S.*

FOR (MDS) 584 The Practice of Environmental Impact Assessment. 4(0-8) F. Alt. yrs.

FOR 593 Colloquium on Tropical Forestry. 1(1-0) S.

FOR (FW) 594 Seminar in Wildlife Management. 1(1 0) Alt. S.

FOOD SCIENCE

FS 201 Food Science and the Consumer. 3(3-0) F.S. An introduction to the science and practice of providing a wholesome, nutritious, economical and readily available supply of basic and processed foodstuffs. Chemical nature, microorganisms, safety, preservation and processing; organic and health foods; nutrition and the consumer; world food problem.

CARROLL

FS (ANS, NTR) 301 Modern Nutrition. *Preq: Sophomore standing. 3(3-0) F, S. Food science majors may use as a free elective only. (See Nutrition.)*

FS (ANS, PO) 322 Muscle Foods and Eggs. *Preq: BS 100. 3(2 3) F.* Processing and preserving fresh poultry, red meats, seafoods, and eggs. Ante- and post-mortem events as they affect quality, yield and compositional characteristics of muscle tissues. LARICK

FS (ANS) 324 Milk and Dairy Products. *Preq: BS 100. 2(2-0) S.* Composition of milk and dairy products, federal standards, raw milk procurement, cleaning and sanitizing and quality attributes. HANSEN

FS 331 Food Engineering. *Preq: PY 211 or 221. 3(2 3) S.* Engineering concepts and their applications to the food industry. Mass and energy balances and principles related to fluid flow, heat transfer, steam generation and use, psychrometry, and refrigeration.

HAMANN

FS 400 Principles of Human Nutrition. *Preq: CH 220 or 221. 3(3 0) F.* Sources and properties of nutrients; function of nutrients in the human body; effect of food industry practices on nutrients. ALLEN

FS 402 Food Chemistry. *Preq: CH 220 or 221. 3(2 3) F.* Introduction to the biochemistry of foods emphasizing basic composition, structure, properties and nutritive value. The chemistry of changes occurring during processing and utilization of foods.

E.A. FOEGEDING, SCHWARTZ

FS 403 Food Analysis. *Preq: FS 402. 3(1 6) S.* Principles, methods and techniques for quantitative physical and chemical analyses of food and food products. Results of analyses evaluated in terms of quality standards and governing regulations. HANSEN, BOYD

FS (MB) 405 Food Microbiology. *Preq: MB 401. 3(2 3) F.* Microorganisms of importance in foods and their metabolic activities. Source of microbial contamination during food production, processing and storage. Microbial spoilage; foods as vectors of human pathogens. Physical and chemical destruction of microorganisms in foods and the kinetics involved. Conversions of raw foods by microorganisms into food products. Microbiological standards for regulatory and trade purposes. P. FOEGEDING

FS 416 Quality Control of Food Products. *Preqs: FS 402, MB 401. 3(2 3) S.* Organization and principles of quality control for the food industry. Food laws and regulations, standards and specifications, sampling, statistical quality control, tests, cleaning and sanitation, and process control. SHELDON

FS 421 Food Preservation. *Coreq: MB 401. 3(2 3) F.* An examination of methods employed in the preservation of foods. Major emphasis on thermal, freezing, drying and fermentation processes and their relationship to physical, chemical and organoleptic changes in product. The relationship of these preservation techniques to the development of an overall processing operation. CARROLL

FS 423 Muscle Food Technology. *Preqs: FS 322, 402, 421. 3(2-3) S.* Chemistry, processing principles, quality, functional evaluation and storage stability of processed muscle food products. LARICK

FS 425 Processing Dairy Products. *Preqs: FS 324, 421. 3(2-3) F.* Unit operations in dairy processing. Formulation, processing, packaging and evaluation of fluid milk and manufactured products. HANSEN

FS (HS) 462 Postharvest Physiology. *Preq: BO 421. 3(3 0) S.* Preharvest and postharvest factors that affect market quality of horticultural commodities with an emphasis on technologies to preserve postharvest quality and extend storage life of fruits, vegetables and ornamentals.

FS 490 Food Science Seminar. *Preq: Senior standing in Food Science or related field. 1(1 0) S,F.* Development of professional enhancement skills: resumé preparation; interviewing techniques; collection, organization and intergration of technical information into an oral report; critical evaluation of information and presentations. Student researches and reports on a topic of current interest in the food industry.

FS 492 External Learning Experience. *Preq: Sophomore standing. 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

FS 493 Special Problems in Food Science. *Preq: Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

FS 495 Special Topics in Food Science. *1 3 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

FS 504 Food Proteins and Enzymes. *Preq: FS 402 or BCH 451. 3(2-3) Alt. F.*

FS 509 Food Lipids. *Preq: FS 402. 1(1 0) Alt. S.*

FS 510 Food Carbohydrates. *Preq: FS 402. 1(1-0) Alt. S.*

FS (NTR) 530 Human Nutrition. *Preqs: FS 400 or NTR 415 or 419; BCH 451. 3(3-0) S.*

FS 551 Food Ingredient Technology in Product Development. *Preqs: FS 402, 405, 421. 4(3 3) S.*

FS 580 Food Kinetics. *Preqs: MA 212, FS 331, FS 402, FS 405 or CI. 3(3 0) Alt. F.*

FS (BAE) 585 Food Rheology. *Preqs: FS 331 or MAE 314. 3(2-3) Alt. F.*

FS 591 Special Problems in Food Science. *Preq: Grad. or sr. standing. Maximum 6. F,S,Sum.*

FISHERIES AND WILDLIFE SCIENCES

FW (ZO) 221 Conservation of Natural Resources. *3(3-0) F,S,Sum.* Importance of natural resources and their role in the human environment. The physical, biological and ecological principles underlying natural resource conservation with attention to the biological consequences of human impacts. BROMLEY, NOBLE

FW (FOR) 310 Fisheries and Wildlife Inventory and Management. *Preqs: Junior standing in SFW, FOR, CON, or SZO; FW ZO 221, 6(0-18) Sum.* Field exercises involving resource inventory, habitat relationships, community structure and analysis, population estimation, forest mensuration and silviculture, and habitat manipulation. Activities predominately field-oriented in an off-campus environment. Overnight trips to observe management activities required. LANCIA

FW (ZO) 353 Wildlife Management. *Preqs: BS 100, ZO 201 or ZO 303, 3(3 0) F.* Describes historical development from empirical practices to the scientific American system. The principles of management, protection, and conservation of those warm blooded vertebrates of aesthetic, sport or food values in urban, rural and wilderness areas. POWELL

FW (FOR) 404 Forest Wildlife Management. *Preqs: 9 hrs. Biological Sciences, 3(3-0) S.* Relationships between forest and wildlife management and the effects of silvicultural systems on wildlife. Species-habitat requirements, forest wildlife management techniques, and forest wildlife policies and economics. LANCIA

FW (ZO) 420 Fishery Science. *Preqs: ZO 201 or 303, ZO 360, 3(2 2) F.* Fishery biology and ecology. Emphasis on the life history and biology of important sport and commercial fishes, the role of fishes in aquatic ecosystems, fisheries population biology, and theory and practice of fisheries management. Examples from freshwater, estuarine and marine systems. Laboratory covers methodology, sampling, age and growth analyses, and population estimation. CROWDER

FW (ZO) 430 Fisheries and Wildlife Administration. *Preqs: PS 201, PS 202, FW (ZO) 420, FW (ZO) 353, 3(3 0) S.* Describes and compares the administrative structures and programs of federal and state fish and wildlife agencies and develops an understanding of the basis on which these agencies function. Evaluate the interrelationships that fisheries wildlife professionals, special interest groups, public agencies and legislative bodies play in resource management programs. DOERR

FW 485 Natural Resources Advocacy. *Preq: ENG 333, Jr. or Sr. level with at least 10 hours of biology, 3(2 3) S.* Analysis of natural resources problems as they affect management agencies and user groups. Development of professional attitudes, policies, and skills needed for the management of sensitive natural resource issues through application of techniques in the field. Student presentations, demonstrations and development of natural resource planning models that integrate biological skills with management alternatives and are critiqued by resource field staff. BROMLEY

FW 492 External Learning Experience. *Preq: Sophomore standing, 1 6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

FW 493 Special Problems in Fisheries and Wildlife Sciences. *Preq: Sophomore standing, 1 6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

FW 495 Special Topics in Fisheries and Wildlife Science. *1 3 F.S., Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open to Advanced Undergraduates

FW (ZO) 515 Growth and Reproduction of Fishes. *Preq. or Corqs: GN 411, ZO 420, 421, 441, 3(2 3) S. All yrs.*

- FW (ZO) 553 Principles of Wildlife Science.** *Prereq: ZO (BO) 360. 3(2-3) F.*
- FW (ZO) 554 Wildlife Field Studies.** *Prereq: Nine hrs. of FW or graduate standing. 3(2-3) S. Odd yrs.*
- FW (ZO) 586 Aquaculture I.** *Prereqs: ZO (BO) 360, sr. or graduate standing. 3(3-0) F.*
- FW (ZO) 587 Aquaculture I Lab.** *Prereqs: ZO (BO) 360, sr. or graduate standing; Coreq: FW 586. 1(0-3) F.*
- FW (FOR) 594 Seminar in Wildlife Management.** *1(1-0) S. Alt. yrs.*

GRAPHIC COMMUNICATIONS

GC 101 Engineering Graphics I. *3(1-2) F,S,Sum.* Graphical representation and solution of 2D and 3D spatial problems. Emphasis on development of logical and analytical approaches to problem solution. Conventional methods of graphically describing size and shape to represent basic mechanical elements. Includes practical engineering drawing applications.

GC 120 Foundations of Graphics. *Credit cannot be given for both GC 101 and GC 120. 3(2-2) F, S.* Introduction to technical orthographic, axonometric, oblique and perspective sketching and drawing for non-engineering students. Major emphasis is on describing shape and size of spatial problems by graphic methods. Application of graphical approaches to problem solving. Opportunity to concentrate on problems relevant to each student's specific area of study.

GC 200 Applied Computer Aided Drawing. *Prereqs: GC 101 or GC 120, and consent of the instructor. Restrictive enrollment. 3(2-2) F,S.* Uses and techniques of computer aided drawing for industry, based on principles and standards of engineering graphics. Systematic methods of visualizing, constructing and graphically modeling two and three dimensional objects and materials for manufacturing and construction. Techniques for creating, storing, retrieving, scaling, editing, dimensioning and printing out drawing data base files.

GC 207 Engineering Graphics II. *Prereq: GC 101 or GC 120. 3(2-2) F,S.* Advanced engineering graphics concepts and analytical skills relevant to the preparation of design, detail, and assembly production drawings for communicating technical data. General manufacturing materials and processes and the representation of common fasteners, basic machine elements, and structural components. Freehand sketching and instrument drawing emphasized.

GC 300 Advanced Graphics Development with CAD D. *Prereq: GC 200 and consent of instructor. 3(2-2) F,S,Sum.* Interaction with advanced integrated computer aided drafting design and modeling workstations. Develop and define accurate geometry of machine parts and analyze problems involving spatial relationships. Includes 2 dimensional drafting and design and 3 dimensional solid modeling CAD D packages. Engineering drawing fundamentals and standards will be emphasized.

GC 320 3D Spatial Relations. *Prereq: GC 101. 3(2-2) F,S,Sum.* Analysis and solution of three dimensional space problems utilizing graphic principles of orthogonal projection techniques. Application of studies of lines, surfaces, solids, surface intersections, surface development, vectors, and civil, mechanical, and geographical structures.

GC 420 Visual Thinking. *Designed for Engineering and technical students. 3(2-2) F,S,Sum.* Develop visual thinking skills through a series of exercises using various visual media. Integrates and stresses drawing and construction activities essential to visual thinking. Emphasis on direct observation (seeing), mental imagery and sketching that is based upon three dimensional space. Develops students' visual and drawing skills and provides for their application toward solving open ended spatial problems. Intended for the scientific and technically oriented student.

GC 496 Special Topics in Graphic Communications. *Preq: Consent of instructor. 1 4, F.S.Sum.* Topical study in areas of current interest and need to students and or needs of curricula served by Graphic Communications.

GRAPHIC DESIGN

GD 200 Introduction to Graphic Design. *3(3 0) F.* Primary concepts of the design of visual communication and how they are applied by practitioners. Discussion of graphic design problem solving that draws heavily on ideas from the fine arts, social sciences, humanities. Student demonstration projects on methods, criticism, concern for context, communication and audience.

GD 201 Graphic Design Studio I. *Preq: DF 101, DF 102. Coreq: GD 212, GD 217. 6(0-9) F.* Principles and language of graphic design. Analysis, organization, invention of two-dimensional form for the purpose of communicating information, concepts, emotions. Varied means of graphic representation are explored.

GD 202 Graphic Design Studio II. *Preq: GD 201, GD 217, GD 212. Coreq: GD 255, GD 317. 6(0-9) S.* Methods and processes of graphic design problem solving. Student exercises define communication problems; evaluate analytical, synthetic, and intuitive approaches to problem solving; develop critical thinking, oral presentation, and writing skills. Emphasis on the "appropriateness" of form to a given context.

GD 212/GD 212L Photography for Graphic Design. *Preq: DF 101, DF 102. 3(1-4) F. School of Design majors only.* Technical, formal, theoretical issues related to the design of photographic images for graphic design. Students shoot and develop 35 mm black and white images that demonstrate how specific meaning is constructed and how photographs relate to reproduction by offset printing. Access to a 35mm camera required.

GD 217 Typography I. *Preq: DF 101, DF 102. 3(1-4) F. School of Design majors and approved minors only.* Typography as a medium of visual communication. Student exercises focus on type as image and the relationship between visual and verbal language; the expressive characteristics of letterforms and text explored. Terminology, typographic history, technical issues related to typography.

GD 255 Graphic Design Materials and Processes I. *Preq: GD 201, GD 212. 3(1 4) S.* Media, tools, processes that broaden students' image making abilities. Students use technology in the School of Design Media Center to experiment with form and communication in support of graphic design studio experiences. Techniques necessary for preparing comprehensives included.

GD 292 Special Topics in Graphic Design. *Preq: Consent of instructor. 1 3 F.S.Sum.* Topics of current interest in Graphic Design. Normally used to develop new courses.

GD 301 Graphic Design Studio III. *Preq: GD 202, GD 212, GD 255, GD 317. Coreq: GD 242, GD 417. 6(0-9) F.* Theoretical information related to semiotics and communication theory applied through demonstration projects. Projects center on tailoring communication to audiences and acknowledging the role of context in the interpretation of form.

GD 312 Advanced Photography for Graphic Designers. *Preq: GD 212, GD 317, GD 202. 3(1 4) F,S,Sum.* Advanced visual communication problems in which students create and use their own photography in typographic graphic compositions. Emphasis on the formal and communicative relationships of image and text. Access to a 35 mm camera required.

GD 317 Typography II. *Preq: GD 217. 3(1 4) S.* Exploration of design using text type and typographic technology. Student exercises explore congruency between visual and verbal hierarchies, expressive use of typographic form, format/informational organization problems, and technical details of typographic specification and computer layout.

GD 355 Graphic Design Materials and Processes II. *Preq: GD 255, GD 301. 3(1 4) S.* Technology and concepts related to preparing art for offset printing. Technology in the service of ideas; examination of ways in which technical concerns enhance the formal communicative opportunities for graphic design. Included is experience in preparing mechanicals on the computer.

GD 400 Advanced Graphic Design Studio. *Preq: GD 301, GD 417, GD 242. Graphic Design majors only. 6(0 9) F,S,Sum.* Advanced visual communication problems integrating typographic, photographic, and historical concepts in graphic design studio projects. Projects reflect applications with specific audiences, contexts, and production criteria.

GD 415 Microcomputers in Graphic Design. *Preq: GD 301; GD 355. 3(1-4) S.* Intermediate-level course in microcomputer imaging, processing and production for Graphic Design.

GD 417 Typography III. *Preq: GD 202, GD 317. 3(1 4) F.* Advanced problems of typographic expression communication in which typographic variables are used to alter, expand, or reinforce verbal meaning. Historic precedent and experimentation with the conventions of typographic form. Impact of the computer on changes in typographic aesthetics.

GD 492 Special Topics in Graphic Design. *Preq: Consent of instructor. 1-3 F,S,Sum.* Topics of current interest in Graphic Design. Normally used to develop new courses.

GEOGRAPHY

GEO 200 Principles of Geography. *3(3 0) S.* Basic ideas in the field of geography. The scope of geography as an academic field explored. Emphasis placed on mastery of geographic tools, e.g., maps, globes, and media materials and sources. Regional study of contemporary world.

GEO (ECI) 300 World Regional Geography. *Preq: GEO 200. 3(3-0) S.* Geography of selected industrial and Third World regions in which the evolution of settlement, culture, economy and political forms are treated in geographical perspective.

GENETICS

GN 301 Genetics in Human Affairs. *3(3-0) F,S,Sum.* Appreciation and understanding of genetics in everyday life. Genetic perspective on normal human development, birth defects, birth control, cancer, organ transplants, intelligence, mental illness, and radiation and chemical exposure and issues raised by applications of recently developed genetic techniques such as in vitro fertilization, genetic engineering and prenatal monitoring.

McKENZIE

GN 411 Principles of Genetics. *Preqs: BS 100, Junior standing. 4(4-0) F,S,Sum.* Basic concepts and principles of prokaryotic and eukaryotic genetics. Mendelian inheritance, polygenic inheritance, linkage and mapping, chromosome aberrations, population genetics, evolution, DNA structure and replication, gene expression, mutation, gene regulation, extranuclear inheritance, bacterial and viral genetics, and recombinant DNA technology.

ANDREWS, EMIGH

GN 412 Elementary Genetics Laboratory. *Coreq: GN 411. 1(0-3) F,S.* Genetic experiments and demonstrations using a variety of bacterial, plant and animal organisms. Mendelian inheritance, linkage analysis, population genetics, cytogenetics, mutation, molecular genetics and biochemical genetics.

GARDNER

GN 492 External Learning Experience. *Preq: Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

GN 493 Special Problems in Genetics. *Prq: Sophomore standing. 1 6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Arrangements must be initiated by student and approved by a faculty adviser and the departmental teaching coordinator.

GN 495 Special Topics in Genetics. *1-3. F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

GN 501 Genetics I. Molecular Genetics. *Prq: GN 411. 1(1 0) F.*

GN 502 Genetics I. Biochemical Genetics. *Prq: GN 411. 1(1-0) F.*

GN 503 Genetics I. Developmental Genetics. *Prq: GN 411. 1(1 0) F.*

GN 504 Human Genetics. *Prq: GN 301 or 411 or equivalent. 3(3 0) F.*

GN 509 Genetics II. Population Genetics. *Prq: GN 411; Coreq: ST 511. 1(1 0) S.*

GN 510 Genetics II. Quantitative Genetics. *Prq: GN 411; Coreq: ST 511. 1(1 0) S.*

GN 511 Genetics II. Cytogenetics. *Prq: GN 411; Coreq: ST 511. 1(1 0) S.*

GN (PO) 520 Poultry Breeding. *Prq: GN 411. 3(2 2) S.*

GN (ZO) 540 Evolution. *Prq: Nine credits in biological sciences. 3(3-0) S.*

GN 560 Molecular Genetics. *Prqs: GN 411; BCH 451. 3(3 0) F. Alt. yrs.*

GN (BCH) 561 Biochemical and Microbial Genetics. *Prqs: BCH 451 or 551, GN 411 or 505, MB 401 or equivalent. 3(3-0) F. Alt. yrs.*

GREEK LANGUAGE AND LITERATURE

GRK 101 Elementary Greek I. *3(3 0) F.* Introduction to Classical Greek. Greek alphabet, basic grammar and syntax. Readings include Plato, Lysias and the New Testament.

GRK 102 Elementary Greek II. *Prq: GRK 101. 3(3-0) S.* A second course in Classical Greek, continuing and expanding the work of GRK 101. Completes study of grammar. Readings from major authors including Herodotus, Thucydides, and Xenophon.

GRK 201 Intermediate Greek I. *Prq: GRK 102. 3(3 0) F.* Introduction to Greek prose. Emphasis upon improvement of reading skill through vocabulary acquisition and study of complex grammar. Introduction to Attic dialect through reading Plato, and Koine Greek through reading the New Testament. Examination of the importance of these works to Western literature and culture.

GRK 202 Intermediate Greek II. *Prq: GRK 201. 3(3 0) S.* Reading in Homer's *Iliad* and the New Testament. Techniques of oral poetry. Study of the use of myth, and of the literary and historical significance of the *Iliad*. Analysis of differences between classical and Koine Greek in the New Testament.

GRK (LAT) 310 Classical Mythology. *3(3 0) F.* Greek and Roman mythology through the writings and art of the Classical period. Discussion of creation stories, the major gods and heroes, the underworld and afterlife. Intellectual religious and educational role of myth and of the most important theories of interpretation and classification. All readings and discussion in English.

GRK 320 Greek Tragedy in Translation. *3(3 0) F.* Tragedies of Aeschylus, Sophocles and Euripides in translation. Literary and social aspects of individual plays and tragic genre in fifth century. Selections from Aristophanes, Plato, Aristotle and Seneca on Greek tragedy.

GRK 333 Medical Terminology. *2(2-0)S.* Study of the formation of medical terms from their Greek and Latin roots designed both to build vocabulary and to teach the uses of a medical dictionary.

GRK 371 The Origins of American Mythology. *3(3-0)S.* Oral-traditional literature, formulaic myth composition and the Indo-European origins of the American folk hero. Readings include *Iliad*, *Gilgamesh*, Sanskrit *Puranas* and *Beowulf*; films such as *Stage coach* and *Superman* are included.

HISTORY OF ART

HA 201 History of Art From Ancient Greece Through the Renaissance. *3(3-0)F,S.* Art from Ancient Greece and Rome through Italian Renaissance. Major art forms of painting, sculpture, and architecture.

HA 202 History of Art From the Renaissance Through the 20th Century. *3(3-0)F,S.* Art from the Northern Renaissance in Europe through the 20th century in Europe and America: painting, sculpture and architecture recent mixed media techniques such as collage and trottage.

HA 203 History of American Art. *3(3-0)S.* A history of American Art (painting, sculpture and architecture) from the Colonial Period through the 20th century.

HA 298 Special Topics in Art History. *3(3-0).* Special topics in art history with emphasis on chronological periods such as 20th century art of the Italian Renaissance or on fields of art such as paintings, sculpture, photography, or architecture.

HA 310 History of Art and Photography. *3(3-0)Alt. yrs.* History of and the interaction between art and photography from the invention of photography to the present.

HA 320 American Decorative Arts. *3(3-0)Alt yrs.* History of American art (painting, sculpture, and architecture) from Colonial Period through 20th century.

HA 401 19th Century European Art. *Preq: HA 201 or HA 202. 3(3-0)F. Alt. yrs.* Major stylistic movements of 19th century European art and the theoretical basis for their development. Covers Neo-Classicism, Romanticism, Realism and Impressionism, and Post Impressionism.

HA 404 Italian Renaissance Masters. *Preq: 3 hrs. of HA. 3(3-0). Alt. yrs.* Development of Italian Renaissance art 1300-1550, including the pioneers of Giotto and Duccio; founders of the early Renaissance: Masaccio, Donatello, and Brunelleschi; great masters of the High Renaissance: Michelangelo, Raphael and Leonardo da Vinci. Works of art analyzed in terms of style, subject matter and historical context.

HA 498 Independent Study in History of Art. *Preq: 3 hrs. of HA and permission of instructor. 1-6.* Directed independent study of topics in the history of art.

HISTORY

Note: 200-300 level courses open to all students without prerequisite. Previous course work in any particular field of history is not necessary in order to take any 200-300 level course.

HI 205 Western Civilization Since 1400. *3(3-0)F,S.* A survey of Western Civilization from the Renaissance to the present.

HI 207 Ancient World to 180 A.D. *3(3-0)F,S.* The ancient cultures of the Middle East, Greece and Rome, including Mesopotamian, Egyptian, Hebrew, Phoenician, Greek and Roman societies and cultures.

HI 208 The Middle Ages. *3(3-0)F,S.* Medieval civilization as it emerged from the declining Roman Empire through its apogee in the 13th century. The transition from the classical to the medieval world, the impact of the Germanic influx, the Islamic influence, the Crusades, and the political, economic, and social institutions of the High Middle Ages.

HI 209 Europe, Renaissance to Waterloo, 1300-1815. *3(3 0) F,S.* Transition from the medieval to modern Europe; decline of medieval institutions, Renaissance, Reformation and Counter Reformation, rise of Absolutism, English 17th-century revolution, French Revolution and Napoleonic era.

HI 210 Modern Europe 1815-Present. *3(3-0) F,S.* Survey of the history of European societies and political systems from 1815 to the present.

HI 215 Latin America to 1826. *3(3-0) F,S.* The origins and development of social, political, economic and religious institutions from pre-conquest times to the achievement of independence. The ancient American cultures; Spain and Portugal before 1492; conquest and settlement, Spanish rule in theory and practice, economic life, the Church, land and labor; the African contribution; the Portuguese in Brazil; the independence movements.

HI 216 Latin America Since 1826. *3(3 0) F,S.* Social, political, economic, and intellectual life in the 19th and 20th centuries in Central and South America. The social structure of the new nations; 19th century liberalism; the force of tradition; relations with Europe and the United States; economic change; caudillo rule; 20th century upheavals; revolutions; political conflict.

HI 221 British History to 1688. *3(3-0) F,S.* History of the British peoples from earliest times to the Glorious Revolution. Social, political, constitutional developments; relationship between history and literature; synthesis of British cultures.

HI 222 History of British Cultures and Societies. *3(3 0) F,S.* British people from Glorious Revolution to the present. Social, political, constitutional development; history and literature; growth and decline of British empire; spread of British culture.

HI 233 The World in the 20th Century. *3(3-0) F,S.* National and international problems in the 20th Century Western and non-Western world; institutions and ideas at the turn of the century, origins and effects of the First World War, the postwar challenge to Western democratic supremacy, the Second World War, and problems of the postwar period.

HI 251 Early American History. *3(3-0) F,S.* Themes in early American history; colonial clash and mix of culture; generation of an "American" consciousness; federalism and democracy in national politics; expansion and immigration; racial and sectional division.

HI 252 Modern American History. *3(3 0) F,S.* Themes in modern American history, impact of war on American foreign and domestic policy; the repercussions of industrialization and economic modernization; continuity and change in American institutions and values; problem solving in pluralistic society.

HI 263 Asian Civilization to 1800. *3(3 0) F,S.* Introductory survey of the great civilizations of Asia; particular attention to India, China and Japan. Emphasis on comparative study of Asian religions, political systems, art, and literature.

HI 264 Modern Asia: 1800 to Present. *3(3 0) F,S.* Introductory survey of 19th and 20th century Asia, with attention to Japan, Southeast Asia, India and China. Emphasis on cultural and political crises of the 19th century and revolutionary transformations of the 20th century.

HI 275 Introduction to History of South and East Africa. *3(3 0) F,S.* The history of Southern and East Africa. The African kingdoms (Lunda, Buganda, and Zulu); the European encroachment; the origins of colonialism and the character of colonial societies and economies, South African apartheid; African protest, nationalism and independence.

HI 276 Introduction to History of West Africa. *3(3 0) F,S.* The history of Western Africa. Forest civilizations and the slave trade, trade and the expansion of Islam, colonialism in West Africa; African nationalism and the achievement of independence; and post colonial West Africa.

HI 298 Special Topics in History. *3(3-0) F,S.* Used for new course development and for presentation of material or techniques not normally available in regular course offerings.

All 300 level History courses add the following prerequisite statement: 3 hours of History or Sophomore Standing.

- HI 305 Teaching World History.** *Correq: ECI 460, 3(3-0) F.* Introduction to content for teaching world history.
- HI (REL) 320 Religion in American History.** *Preq: 3 hours of History or Sophomore Standing, 3(3 0) F.* Representative people, movements, and thought in the major religions within the context of American society and culture.
- HI 321 Ancient and Medieval Science.** *3(3 0).* Selected topics in the history of pre-modern science are studied for both their intrinsic interest and to gain perspective on the nature of modern science. Examples are taken from pre-history, Mesopotamia, Egypt, Greece, Rome, Islam, and the medieval Christian West, with the possibility of comparisons to other cultures. SYLLA
- HI 322 Rise of Modern Science.** *3(3 0).* Science in the Renaissance and Scientific Revolution of the 16th and 17th centuries. Newtonian science. Mechanics and the chemical revolution in the 18th century. Scientific synthesis in the 19th century: physics, chemistry, geology, and biology. 20th century revolutions in physics. Attention is paid both to scientific ideas and to the cultural and institutional contexts of science. MULHOLLAND, KIMLER, SYLLA
- HI (REL) 324 American Religion After Darwin.** *Preq: 3 hours of History or Sophomore Standing, 3(3 0).* (See Religion.)
- HI 333 History of American Sport.** *3(3-0).* A history of American sport: a reflection of and a factor within the development of American history.
- HI 336 America in Movies.** *3(2 3).* An introductory study of American popular culture through important motion pictures portraying major themes, events and lives in American history. The "film image" is compared with leading historians' accounts of the same episodes in order to introduce some problems of what is "true history."
- HI 339 History of Russia and the USSR.** *3(3 0).* Russian and Soviet history from earliest times to the present. Political, social and cultural traditions of the Great Russians; formation of a multi national empire in 18th and 19th Centuries; causes and consequences of 1905 and 1917 Revolutions; Stalin's upheaval and tyranny; origins and failure of "consumer communism"; Perestroika, the end of the CPSU, and the breakup of the USSR. SURH
- HI 341 Technology in History.** *3(3-0) S.* The role of technology in society from earliest times to the present. Major achievements in technology and an examination of the nature of invention, innovation and adaptation of technologies and their impact on Western Civilization. MULHOLLAND
- HI 346 The Vietnam War.** *3(3-0).* The Vietnam War in historical context. Relations of Vietnam with neighbors, north south division, colonial influences; the origins and progression of American involvement; the course of the war; the impact of the war in Asia and America. HOBBS, OCKO
- HI 350 American Military History.** *3(3-0) F.S.* American military experience and its relationship to other historical developments. Use of military force in terms of strategy and tactics and as an element in the nation's diplomatic, political, social, economic and intellectual life. HOBBS
- HI 351 U.S. Naval History.** *3(3 0) S.* The role of the U.S. Navy in American history. Sea power, national defense and foreign policy. The impact of technology on naval warfare and the historical evolution of missions of the U.S. Navy. HOBBS
- HI 364 History of North Carolina.** *3(3 0) F.* History of North Carolina from early European exploration to the present. Features of North Carolina society which made this state similar to and different from other southern states and the nation as a whole. HARRIS, O'BRIEN
- HI 365 The American West.** *3(3-0)* A history of the American Frontier with emphasis on the trans-Mississippi West. Cycles of exploration, conquest, and exploitation of this region. Influence of the frontier in the development of the United States. CRISP

HI 372 African-American History Through the Civil War, 1619-1865. *3(3 0)*. African background and continuity of the particular role, experience and influence of African Americans in the United States through the Civil War. McMURRY

HI 373 African-American History Since 1865. *3(3-0)*. The history of African-Americans from the Reconstruction era through the Civil Rights movement of the 1950s and 1960s to the present. McMURRY

NOTE: Prerequisite for 400 level courses: three hours of history. Junior standing or permission of instructor is required for 400 level courses that meet jointly with 500 level courses.

HI 400 Civilization of the Ancient Near East. *3(3-0) Alt. yrs.* The civilization of Mesopotamia and Egypt from earliest times to the fall of Babylon in 539 B.C. SACK

HI 403 Ancient Greek Civilization. *3(3-0) Alt. yrs.* The history of the Hellenes from the Minoan civilization through Alexander's legacy, with readings in Herodotus and Thucydides. SACK

HI 404 Rome to 337 A. D. *Credit will not be given for both HI 404 and HI 504. 3(3-0) Alt. yrs.* The development of ancient Rome from its origins in Italy, through the rise as an Empire embracing the entire Mediterranean World and Western Europe, to Constantine, Christianity and the foundation of Constantinople. Examines critically the political achievement of a people who rose from an obscure Italian city to a world empire, with emphasis on the analysis of primary sources. PARKER

HI 405 History and Archaeology of the Roman Empire. *Credit will not be given for both HI 405 and HI 505. 3(3 0) Alt. yrs.* Analysis of Rome's rule over the Mediterranean World in the first four centuries A.D. through the use of literary and archaeological sources. Special emphasis on imperial army and frontier security. PARKER

HI 406 From Roman Empire to Middle Ages. *Credit will not be given for both HI 406 and HI 506. 3(3 0) Alt. yrs.* Late Antiquity and the early Middle Ages. The transition from classical civilization to the basis of modern civilizations; the fall of Rome, the Germanic kingdoms, Byzantium, the establishment of Christianity, the birth and growth of Islam. PARKER, RIDDLE

HI (REL) 407 Islamic History to 1798. *3(3 0) Alt. yrs. Credit will not be given for both HI 407 and HI 507.* The history of the Islamic Near East to 1798. Topics include the East Mediterranean before Islam, Muhammad and the development of Islam, sources of Muslim civilization, Islamic law, science, philosophy, art, and architecture, Islam in Spain, India, Asia, and Africa, the Crusades, the Ottomans, Islam and Europe.

HI (REL) 408 Islam in the Modern World. *3(3 0) Alt. yrs.* Evolution of modern Islam from 17th century to the present, North Africa, Middle East and India. Pre modern Islamicate empires, European intervention, Islamic reaction and response. Historical origins of current issues in the Islamic world. GILMARTIN

HI 409 The High Middle Ages. *Credit will not be given for both HI 409 and HI 509. 3(3 0) Alt. yrs.* Medieval culture from 10th through 13th centuries: revival of the Roman Empire, monastic and papal reform, rise of universities, evolution of representative bodies, the Gothic style, troubadour and goliardic poetry, scholasticism, and revival of Roman law. RIDDLE

HI 410 Italian Renaissance. *3(3-0) Alt. yrs. Credit will not be given for both HI 410 and HI 510.* Renaissance humanism, an educational ideal and an awareness of man as the sole creator in the historical world, is examined in its relationship to the Italian republics and principaldoms of the 14th through the 16th century. BANKER

HI 411 The Protestant and Catholic Reformation of the 16th Century. *3(3-0) Alt. yrs. Credit will not be given for both HI 411 and HI 511.* The conditions and criticisms which led to reform and the nature of the institutional and theological changes affected by the various churches and sects. Special attention to Luther and Calvin. BANKER, LURIA

HI 414 France in the Old Regime. 3(3-0) Alt. yrs. *Credit will not be given for both HI 414 and HI 514.* France from the sixteenth century to the Revolution, development of renais sance and absolutist state, social and economic change, religious reform and Enlighten ment, origins and beginnings of the revolution.

HI 415 The French Revolution. Credit will not be given for both HI 415 and HI 515. 3(3-0). Broadly based analysis of France's first revolutionary era; the enlightenment and its impact, the causes and character of the Revolution in France; impact of these events in France and Europe. LURIA

HI 417 Europe in Crisis: 1890-1917. Credit will not be given both for HI 417 and HI 517. 3(3-0) Alt. yrs. Survey of the social, economic, political, ideological changes in Europe on the eve of World War I: prewar origins of fascism and communism; political polarization during World War I to the outbreak of the Bolshevik Revolution. DeGRAND

HI 418 Fascism - Revolution - Reaction: Europe 1918-1939. Credit will not be given for both HI 418 and HI 518. 3(3-0) Alt. yrs. Rise and defeat of revolutionary movements in Central Europe and Italy (1918-1939); emergence and development of communism, fascism and nazism; crisis of the European socialist movement during the 1930's; the Spanish Civil War. DeGRAND

HI 419 Modern European Imperialism. Credit will not be given for both HI 419 and HI 519. 3(3-0) Alt. yrs. Historical background of European Colonialism; its impact on shaping the modern world; influence on modern independence movements, major power foreign policy, Third World concepts in international relations. GILMARTIN

HI 420 European Diplomatic History. Credit will not be given both for HI 420 and HI 520. 3(3-0). Survey of major issues and events in European international relations from the Congress of Vienna, 1815, to the defeat of Axis Powers and the origins of the Cold War in 1945. DE GRAND

HI 421 European Intellectual History: The Eighteenth Century. Credit will not be given for both HI 421 and HI 521. 3(3-0) Alt. yrs. Historical examination of some of the major figures of the European Enlightenment, beginning with Locke and ending with Kant. LaVOVA, VINCENT

HI 422 European Intellectual History: The 19th Century. Credit will not be given for both HI 422 and HI 522. 3(3-0) Alt. yrs. Historical examination of some of the major figures of European thought during the 19th century, beginning with the enthusiasm of the period of the French Revolution and ending with the disillusionment of the fin de siècle. VINCENT

HI 425 Tudor and Stuart England. Credit will not be given for both HI 425 and HI 525. 3(3-0) Alt. yrs. British history from the Reformation through the Civil War. Emphasis on key developments in social, political and economic life: The development of a new concept of kingship, the growing independence of Parliament, the search for religious uniformity and the changing status of the aristocracy and gentry. CARLTON

HI 429 20th Century Britain. 3(3-0) Alt. yrs. British political, social and economic history since 1914, with reference to the effects of two world wars, the growth of the Welfare State, Britain's decline as a power, and its search for a new role in the world. CARLTON

HI 430 Modern France. Credit will not be given for both HI 430 and HI 530. 3(3-0) Alt. yrs. French history from the downfall of Napoleon I to the present, with a short introducto ry survey of the Old Regime and the French Revolution. Curltural, social and economic developments and political trends. VINCENT

HI 431 Germany: Luther to Bismarck 1500-1871. Credit will not be given for both HI 431 and HI 531. 3(3-0) Alt. yrs. Germany from the Reformation to the completion of national unification in 1871. Emphasizes the impact of socioeconomic changes on politics and culture. LaVOVA

HI 432 History of Germany Since 1871. *Credit will not be given for both HI 432 and HI 532. 3(3-0) Alt. yrs.* German history from the unification of 1871 to the present, concentrating on problems of nationalism and political and social reform. LaVOPA

HI 438 Russian Social and Cultural History. *3(3-0) Alt. yrs.* The formation of Russian secular culture in the setting of social backwardness and political repression during the last century of Tsarist Russia. The lives and works of Russia's major writers, thinkers, and political activists considered from the standpoint of modernization, nationalism, and revolution. SURH

HI 439 The Russian Revolution. *Credit will not be given both for HI 439 and HI 539. 3(3 0) Alt. yrs.* The Russian Revolution as a connected episode, from the late Imperial period through the degeneration of Bolshevism under Stalin, the origins of revolutionary politics and the causes of the collapse of Tsarist autocracy; the dynamics of revolutionary events of 1917-1921; economic recovery and cultural pluralism of the 1920s; political repression and industrialization of the 1930s. SURH

HI 441 Colonial and Revolutionary U.S. *3(3 0) Alt. yrs.* Origins of the English colonies in America to the American Revolution. European background to colonization, merging of different cultures, effects of mercantile doctrine, causes of revolution. MIDDLETON

HI 443 U. S. Constitutional History. *3(3-0) Alt. yrs.* The origins and growth of the U. S. Constitution from its English common law heritage to the Modern era. Federalism and judicial interpretation; economic, social, and political movements; expansion of constitutional authority in the 20th century. MIDDLETON

HI (MDS) 445 History of American Technology. *3(3-0) S.* Technology in American history: the ideological, social, economic, and institutional contexts of technological change from the 1760s to the present. Impacts of new technological systems.

HI 446 Civil War and Reconstruction. *Credit will not be given for both HI 446 and HI 546. 3(3-0) Alt. yrs.* Examination of sectional polarization of the 1850's, impact of the war on both northern and southern societies, and trauma of reconstructing the Union. HARRIS

HI 447 History of American Women to 1900. *3(3 0) Alt. yrs.* The historical experience of women in America from the colonial period to 1890. Women's work, education, legal and political status, religious experience, and sex roles: age, class, race, sexual preference, and region as significant variables in women's experience. TYLER

HI 448 American Women in the Twentieth Century. *3(3-0) Alt. yrs. Credit will not be given for both HI 448 and HI 548.* Women's historical experience in America, 1890-1990. Changes in women's work, education, legal and political status, and sex roles, age, class, race, sexual preference, and region as significant variables in women's experience. TYLER

HI 452 Recent America. *Credit will not be given both for HI 452 and HI 552. 3(3 0) Alt. yrs.* Examination of contemporary opinions and "historical" interpretations of major problems in American life since 1939, including World War II, its social and economic consequences; Korea and the Cold War, big business and labor; civil rights and feminist movements; countercultures, Vietnam and Watergate. HOBBS

HI 453 United States-Latin American Relations Since 1823. *Credit will not be given both for HI 453 and HI 553. 3(3 0) Alt. yrs.* Analysis of periods, issues, and events in U.S.-Latin American relations since 1823: Monroe Doctrine, Manifest Destiny, Mexican and Spanish-American Wars, Dollar Diplomacy, Good Neighbor Policy, anti-Communist crusade since 1945, Alliance of Progress, U.S. responses to revolution. Historical perspective on contemporary contemporary inter American problems on drugs, environment, debt crisis, and human rights abuses.

HI 454 History of U.S. Foreign Relations, 1900-Present. *Credit for both HI 454 and HI 554 will not be allowed. 3(3-0).* America's emergence as a world power; American diplomatic history since 1900; the expansion of American economic and cultural relations; the evolution of the American foreign policy bureaucracy; and the historical forces and personalities that have shaped American relations with other nations. BEERS

- HI 455 History of the Civil Rights Movement.** *Credit will not be given both for HI 455 and HI 555. Alt. yrs.* The "black revolution"; stages and leaders of the movement; successes and failures in the fight for desegregation, the vote, and economic opportunity; impact of Civil Rights movement on the United States. McMURRY
- HI 456 American Heritage.** *Credit will not be given for both HI 456 and HI 556. 3(3 0) Alt. yr.* Development of American ideals since colonial times studied through the words of famous Americans and in the context of events like the American Revolution and the Great Depression. Stress on the conflicts, during important crises, between freedom and order, liberty and equality, free enterprise and social justice, religious truth and workaday morality, the nation and the world. JACKSON
- HI 457 Twentieth-Century U.S. Intellectual History.** *3(3 0) Alt. yrs.* American intellectuals and their views on 20th Century topics such as politics, culture, race and gender in historical context.
- HI 458 Modern American Historical Biography.** *3(3 0) Alt. yrs. Credit will not be given for both HI 458 and HI 558.* The impact on American life in the 20th century of some important people in fields such as politics, war and peace, sports and various forms of communication is explored through the medium of historical biography. JACKSON
- HI 461 Civilization of the Old South.** *Credit will not be given for both HI 461 and HI 561. 3(3-0) Alt. yrs.* The distinctive features of the Old South as part of the regional development of United States history. Consideration of colonial factors in the making of the South, development of the plantation system and slavery, Southern social order, intellectual and cultural life, economic development, and rise of Southern nationalism. CRISP, SMITH
- HI 462 Social History of the New South.** *Credit will not be awarded both for HI 462 and HI 562. 3(3 0) Alt. yrs.* Analysis of southern society from the Civil War through the present with an emphasis on social history methods, approaches, and sources. O'BRIEN
- HI 467 Modern Mexico.** *3(3-0) Alt. yrs.* Major developments in Mexican national life since 1821. The 19th century: the era of Santa Anna, the war with the United States, the Reform, the French intervention, and the dictatorship of Porfirio Diaz. The 1910 Revolution and the resulting transformation of Mexico's political, social and economic institutions. Reading knowledge of Spanish helpful but not required. BEEZLEY
- HI 469 Latin American Revolutions in the Twentieth Century.** *Credit for both HI 469 and HI 569 will not be given. 3(3 0) Alt. yrs.* Comparative analysis of causes, participants, process, and outcome of revolutions in Mexico, Bolivia, Cuba, and Central America. SLATTA
- HI 471 Revolutionary China.** *Credit will not be given for both HI 471 and HI 571. 3(3 0). Alt. yrs.* China 1900 to present. Examination of political, cultural, and socio-economic revolutionary phases of China's 20th Century transformation from traditional empire to communism. Particular attention to post-1949 problems of nation-building. OCKO
- HI 472 Modern Japan, 1850 to Present.** *3(3 0) Alt. yrs.* Japan's emergence as a nation and world power. BEERS, OCKO
- HI 474 Modern India.** *3(3-0) F. Alt. yrs.* The history of the Indian sub-continent, from the 16th century to the present. Focus on political, economic and cultural change under the Mughal Empire and the British Raj; the problems of independent India, Pakistan and Bangladesh. GILMARTIN
- HI 475 History of the Republic of South Africa.** *3(3-0).* Evolution of the Republic of South Africa's society, with emphasis on the interaction of diverse peoples and cultures. Particular attention is given to the period since 1870. VICKERY
- HI 476 Leadership in Modern Africa.** *3(3 0) Alt. yrs.* Recent sub-Saharan African political history (excluding South Africa). Overview of concepts, vocabulary, historical trends. Detailed examination of specific African countries as case studies, such as Ghana, Nigeria, Zimbabwe, Tanzania.

HI 480 Scientific Revolution: 1300-1700. *Credit will not be given for both HI 480 and HI 580. 3(3-0) Alt. yrs.* Factors behind dramatic scientific changes of the seventeenth century. Role of mathematics and experiment. Interaction of the new science with trends in philosophy, religion, alchemy, magic, medicine, and with institutional, educational, political, economic and technological factors. SYLLA

HI 481 History of the Life Sciences. *Credit will not be given for both HI 481 and HI 581. 3(3-0) Alt. yrs.* The major ideas, methods, institutions, and individuals that have contributed to the biological sciences from Renaissance to modern times. The connections between the life sciences and other aspects of culture, including the physical sciences, religious belief, medical practice, and agriculture. KIMLER

HI 482 Darwinism in Science and Society. *Credit will not be given both for HI 482 and HI 582. 3(3 0) Alt. yrs.* Darwinism and its reception by the scientific community and the general public. Social impact of theories of evolution as reflected in Social Darwinism, eugenics, sociobiology, and the relationship of science to ethics and religion. KIMLER

HI 491 Seminar in History. *Prereqs: 3 hours of history; Junior standing. 3(3 0) F,S.* Detailed investigation of selected topics in history. Consult Department of History for specific topics.

HI 495 Honors Research in History I. *Open only to seniors in history honors program. 2(0-2).* Preparation of the honors thesis. Topics and procedures to be determined by the student and the supervising faculty member.

HI 496 Honors Research in History II. *Prereq: HI 495. Open only to seniors in history honors program. 4(0-4).* Completion of the honors thesis. Topics and procedures to be determined by the student and the supervising faculty member.

HI 498 Independent Study in History. *Prereq: 3 hours of history. 1 6. F.S.* Extensive readings on predetermined topics focused around a central theme. Permission of the department is required.

HORTICULTURAL SCIENCE

HS 100 Home Horticulture. *Credit is not allowed for both HS 101 and HS 100. For non-majors only. 3(3-0) F,S.* Introduction and review of home horticulture as it relates to the horticultural enthusiast. A general understanding of plant structure and development; house plants, flower arranging, home greenhouses, growing trees, shrubs, and flowers in the home landscape; vegetable and fruit gardening; pesticides for the home gardener, and other related topics. LANE

HS 201 Principles of Horticulture. *3(3 0) F,S.* Basic principles of production, processing and utilization of fruit, vegetable, flower, and ornamental crops. The economic importance and distribution of horticultural enterprises. The roles of horticulture in world nutrition and food supply, improvement of environmental quality in the landscape, aesthetic values and medicinal uses. LANE

HS 211 Ornamental Plants I. *Prereq: BS 100. 3(1-5) F.* Identification, distribution, growth, characteristics, adaptation, and usage of ornamental plants. Emphasizes bedding plants, trees, and gymnosperms. FANTZ

HS 212 Ornamental Plants II. *Prereq: BS 100. 3(1 5) S.* Identification, distribution, growth, characteristics, adaptation, and usage of ornamental plants. Emphasizes shrubs, ground covers, vines, bulbs, and interior landscape plants. FANTZ

HS 301 Plant Propagation. *Prereq: BS 100, or BO 200. 4(3-3) F.* Theories and techniques necessary to the successful clonal and seed reproduction of higher plants. The influence of hereditary, environmental and pathological variation on the plant products. Recent developments in propagation techniques. BALLINGTON

- HS 342 Landscape Horticulture.** *3(2-3) F.S.* Introduction to comprehensive process for small scale landscape projects. Includes garden history, social and environmental analysis, creative problem solving process and the practice of oral, written and graphic communication. HOOKER, TRAER
- HS 371 Interior Plantscapes.** *Preqs: BS 100 or BO 200; second semester sophomore standing. 3(2-3)S.* Identification, selection, installation, utilization, and maintenance of plants commonly used in commercial interior settings. LANE
- HS 400 Residential Landscaping.** *Preqs: HS 211, 212, 342, LAR 234, 430; Coreq. LAR 457, 6(0-9) F.S.* Equips students with the necessary skills to create functional, aesthetic, and humanistic designs for residential and other small scale projects. Aspects of problem identification, project organization, design, execution, and evaluation. Required field trip with fee. HOOKER
- HS 411 Nursery Management.** *Preqs: BS 100, SSC 200, Junior standing. 3(2-3) F.* Principles and practices of production, management, and marketing of field-grown and container grown nursery plants. One of three scheduled weekend field trips required. RAULSTON
- HS 416 Principles of Ornamental Planting Design.** *Preqs: HS 400; LAR 234, 456, 400, 3(2-4)S.* Study and practice of plant selection process for ornamental planting design. Plant form, line, texture, color and scale are related to design principles. Plant cultural requirements and characteristics associated with site microclimates and conditions to promote environmentally sensitive and healthy landscapes. Hands on experience. Two mandatory Saturday field trips. TRAER
- HS 421 Tree Fruit Production.** *Preqs: BS 100 or BO 200, SSC 200, HS 201. 3(2-3) F.* Identification, adaptation, production and marketing methods of the principal tree fruit and nut crops of the United States. Fundamental principles underlying perennial plant culture applied to the production of specific fruit crops with emphasis on the crops of commercial importance in North Carolina. A weekend field trip is required. WERNER
- HS 422 Small Fruit Production.** *Preqs: BS 100 or BO 200; SSC 200, HS 201. 3(2-3) S. Alt. yrs.* Place and value of U.S. small fruit in the agricultural economy and in market and home gardens. Various cultural requirements of these crops and manipulation of their known morphological and physiological traits for successful production. A group project required.
- HS 431 Vegetable Production.** *Preq: BS 100, SSC 200. 4(3-3) F.* The most important commercially grown vegetable crops in the U.S. are treated individually, considering origin, botany, importance, genetics, physiology, storage, and marketing of each, but emphasizing production practices. Applied aspects of commercial field production in North Carolina are treated as a separate unit at the end of the semester. PEET
- HS 440 Greenhouse Management.** *Preq: BS 100 or BO 200. 3(2-3) F.* Perspective of worldwide floricultural production. Selection of greenhouse site, construction, heating, and cooling. Emphasis on greenhouse cost accounting and analysis. Other topics: root media, sanitation, water, fertilization, chemical growth regulation, temperature, light and marketing. Hands-on experience in greenhouse operations plus trips to commercial greenhouses and markets. NELSON
- HS 441 Floriculture I.** *Preqs: BS 100, SSC 200. 3(2-3) F.* Production and marketing procedures for fall-flowering floricultural crops. LARSON
- HS 442 Floriculture II.** *Preqs: BS 100, SSC 200. 3(2-3) S.* Production and marketing procedures for spring-flowering floricultural crops. LARSON
- HS (FS) 462 Postharvest Physiology.** *Preq: BO 421. 3(3-0) S.* Preharvest and post harvest factors that affect market quality of horticultural commodities with an emphasis on technologies to preserve postharvest quality and extend storage life of fruits, vegetables and ornamentals. BLANKENSHIP

HS 471 Tree and Grounds Maintenance. *Preqs: BS 100 or BO 200; PP 315; SSC 200. 4(3 3) S.* Principles and practices of shade tree and grounds maintenance. Shade trees, small flowering trees, and shrubbery; installation, pruning, transplanting, fertilization, structural support, and diagnosis and management of parasitic and non-parasitic disorders. WARREN

HS 490 Horticultural Science Seminar. *Preq: Junior senior standing in horticultural science. May be taken only once for credit. 1(1 0) F.* Presentation of scientific articles, progress reports in research, and special problems in horticulture and related fields. Students are required to select a subject of their interest, with the approval of the instructor, and give one seminar during the semester. Each seminar is formally evaluated by all of the students. LANE, MONACO

HS 492 External Learning Experience. *Preq: Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

HS 493 Special Problems in Horticultural Science. *Preq: Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

HS 495 Special Topics in Horticultural Science. *1 6 F,S,Sum* Selected topics using an intensive literature review, independent study with instructor guidance; or new course development on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

HS 531 Physiology of Landscape Plants. *Preq: BO 421 or CI. 3(2-3) S.*

HS 532 Vegetable Crop Physiology. *Preqs: BO 421, HS 431, SSC 341. 2(2-0) F, Alt.yrs.*

HS 534 Vegetable Crops Practicum. *Preq: HS 431. 3(1 6) S. Alt. yrs.*

HS 595 Special Topics in Horticultural Science. *Preq: CI. 1 6 F,S,Sum.*

HS 599 Research Principles. *Preq: CI. Credits arranged, maximum 6.*

HUMANITIES AND SOCIAL SCIENCES

HSS 110-111 Humanities and Social Sciences Scholars Forum. *Enrollment limited to participants in the Scholars of the College Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

HSS 200 Introduction to Women's Studies. *3(3 0) F.* Multidisciplinary approach to Women's Studies. Exploration of feminist scholarship and research about women and gender in contemporary American society.

HSS 210-211 Humanities and Social Sciences Scholars Forum. *Enrollment limited to participants in the Scholars of the College Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

HSS 298 Special Topics in Humanities and Social Sciences. *1-6 F,S.* Interdisciplinary study of selected topics in the humanities and social sciences.

HSS 310-311 Humanities and Social Sciences Scholars Forum. *Enrollment limited to participants in the Scholars of the College Program. 0(2-0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

HSS (ANT, COM) 392 International and Crosscultural Communication. *3(3 0) S.* Patterns and problems of verbal and non verbal forms of crosscultural communication. Avoidance and management of cultural conflict arising from awareness of characteristics of crosscultural communication. Impact on communication of differing cultural perspectives.

HSS 393 International Affairs Seminar. *3(3 0) F.* An intensive study of selected international issues, each of which will be studied in terms of its global dimensions and implications.

HSS 398 Scholars Seminar in Humanities and Social Sciences I. *Enrollment limited to participants in the Scholars of the College program. 3(3 0) F.* Interdisciplinary study of selected topics in the humanities and social sciences; required of Scholars of the College students in their junior year.

HSS 399 Scholars Seminar in Humanities and Social Sciences II. *Enrollment limited to participants in the Scholars of the College program. 3(3-0) S.* Interdisciplinary study of selected topics in the humanities and social sciences; required of Scholars of the College students in their junior year.

HSS 400 Research Seminar in International Affairs. *Preq: HSS 393.1-3 S.* Research seminar on individual topics; reports presented to the seminar, and research paper presented to Committee on International Studies.

HSS 410-411 Humanities and Social Sciences Scholars Forum. *Enrollment limited to participants in the Scholars of the College Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

HSS (ALS) 490 International Seminar. *Junior standing. 1(1 0) S.* (See Agriculture and Life Sciences.)

HSS 492 Seminar in Women's Studies. *Preq: HSS 200. 3(3-0) S.* Examination of a topic or core area in Women's Studies, such as: women in literature, psychology of sex roles, changing gender relations in families, women's labor force participation, and the history of the women's rights movement.

INDUSTRIAL DESIGN

(Also see DN Design; GD Graphic Design)

ID (TAM) 170 Textile Design Orientation. *1(0 2) S.* Orientation course designed to present the breadth and scope of the Textile Design profession, together with future opportunities in this field.

ID 255 Contemporary Manufacturing Processes I. *3(3-0) F.* Introduction to mass production processes and their influence on design. Wood, paper and metal manufacturing processes utilized in quantity production. Emphasis on materials comparison and process selection in relation to product function, form, human factors and productivity. Field trips required.

ID 256 Contemporary Manufacturing Processes II. *3(3-0) S.* Second course in mass production processes and their influences on design. Emphasis on material search and process selection in relation to form, function, human factors, finishes, and joining methods. Plastics and rubber and their specific manufacturing processes utilized in mass production.

ID 262 Professional Practice in Product Design. *3(3-0) F.* Issues and situations encountered in a design practice. Topics include portfolio and resume preparation, patents, contracts, basic marketing skills within corporations and in freelance design.

ID 292 Special Topics in Industrial Design. *Preq: Consent of instructor. 1 3 F,S, Sum.* Topics of current interest in Industrial Design. Normally used to develop new courses.

ID 318 Ideation I. *3(2 2) F.* The ideation process of conceiving, developing and recording ideas two-dimensionally. These techniques defined and practiced as an extension of understanding the human ideomotor process.

ID 400 Product Design Studio. *Preqs: DF 102; written approval of Department Head and Dean. 6(0 9) F,S,Sum.* A progression of studio experiences that expand upon and combine the intellectual and manual skills required for the practice of Industrial Design. Emphasis on identifying and solving design problems through manipulation of form, application of human factors, product safety awareness, appropriate combination of materials and fabrication techniques, and the presentation of concepts.

ID 415 Microcomputer Imaging in the Design Process. *Preq: School of Design students only. 3(3-0) F,S.* The computer as a design tool for simulating two and three dimensional images; experimentation with graphics generation; exposure to computer generated video images. No computer experience is necessary.

ID 418 Ideation II. *3(2-2) S.* This is an advanced course which expands the ideation process with greater emphasis directed toward the creative development and recording of conceptual design phase.

ID 492 Special Topics in Industrial Design. *Preq: Consent of instructor. 1 3 F,S, Sum.* Topics of current interest in Industrial Design. Normally used to develop new courses.

ID 494 Internship in Product Design. *Preqs: Junior standing in Product Design; 3.0 GPA or better; and written approval of Department Head. Maximum 6 credit hours. 3 6 F,S.* Supervised field experience in product design offices and organizations.

ID 495 Independent Study in Product Design. *Preqs: Junior standing in Product Design; 3.0 GPA or better; and approval of Department Head. Maximum 6 credit hours. 1-3 F,S.* Special projects in product design developed under the direction of a faculty member on a tutorial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

ID 511 Product Design Materials & Processes I. *Preq: Grad. standing; waiver of prerequisite is at the discretion of the instructor. 3(3-0) F.*

ID 512 Product Design Materials & Processes II. *Preq: Grad. standing; waiver of prerequisite is at the discretion of the instructor. 3(3 0) S.*

INDUSTRIAL ENGINEERING

IE 100 Introduction to Industrial Engineering. *1(0 2) F,S.* Introduction to industrial and management engineering practice and concepts, including activity planning and control, human performance, resource allocation, operations improvement, and management systems. Illustrations of such functions in manufacturing, commercial, government or service organizations. Discussions and problems which relate to the design and operation of integrated systems of humans, machines, information and materials. Problem analysis, logic and application of the computer. SMITH

IE 240 Furniture Product Engineering. *Preq: GC 101. Open only to students pursuing BSIE, Furniture Manufacturing Option, Wood Science and Technology, and Industrial Design. 3(3 0)F.* Introduction to use and properties of materials and construction methods used in mass production of furniture. Examines techniques of product engineering and its role in determining product quality and manufacturability. Emphasis on principles of computer-based product development, specification, and performance evaluation.

IE 241 Furniture Manufacturing Processes I. *Preq: IE 240. Open only to students pursuing BSIE, Furniture Manufacturing Option, Wood Science and Technology, and Industrial Design. 3(3 0) S.* Furniture manufacturing technology emphasizing mass production equipment capabilities and capacities. Relationship of product characteristics to machine selection and process planning activities. Introduction to computer controlled machining and integrated manufacturing systems. CULBRETH

IE 307 Real-Time Control of Manufacturing Processes. *Preq: CSC 111; Coreq: IE 100 and ECE 431. For IE, FMM and CSC majors and IE minors only. 3(2-2) F.S.* Introduction to the concepts of real time control of manufacturing processes. System architecture, interface techniques, sensors and controls. An introduction to C as a language for manufacturing control and experience in the use of distributed computing resources. KING, KAY

IE 308 Control of Production and Service Systems. *Preqs: IE 361, ST 371. 3(3-0) S.* Planning and control of production and service systems. Production organization, flow and inventory control methods. Systems approach.

YOUNG, HODGSON, NUTTLE, ELMAGHRABY

IE 311 Engineering Economic Analysis. *Preq: MA 102, MA 112 or MA 113. 3(3-0) F, S, Sum.* Engineering and managerial decision making. The theory of interest and its uses. Equivalent annual costs, present worths, internal rates of return, and benefit cost ratios. Accounting depreciation and its tax effects. Economic lot size and similar cost minimization models. Sensitivity analysis. Cost dichotomies: fixed vs. variable, and incremental vs. sunk, use of accounting data. Replacement theory and economic life. Engineering examples. BERNHARD

IE 340 Furniture Manufacturing Processes II. *Preq: IE 241. Coreq: IE 352. 3(3 0) F, A* survey of furniture manufacturing technology. Emphasis is on operations, production rates, and the integration of many types of equipment into a manufacturing system.

IE 341 Furniture Manufacturing Facilities Design. *Preq: IE 340. Open only to students pursuing BSIE, Furniture Manufacturing Option, Wood Science and Technology, and Industrial Design. 3(3 1) S.* Engineering design of integrated furniture manufacturing facility. Emphasis on a computer graphics based plant layout involving equipment selection arrangement, materials handling and storage system design, and space utilization techniques. Additional topics include plant support and environmental systems.

IE 345 Principles of Upholstery. *Preq: IE 241. 2(2 0) F.* The upholstery industry through an examination of product function, frame design principles, upholstery constructions, material properties, and manufacturing processes. Special problems involved in upholstery merchandising, order processing, labor utilization, inventory control, and costing.

IE 346 Casegoods Manufacturing. *Preqs: IE 340, WPS 301. 2(2 0) S.* Selected topics in casegoods furniture design, construction, and manufacturing. Emphasizes panel construction, panel manufacturing, and finishing methods. Applications in knock-down furniture design.

IE 347 Furniture Manufacturing Facilities. *Preq: IE 241; Coreq: IE 340. 2(2-0) Alt. F.* Types and characteristics of furniture plant support systems: boiler operations, steam generation and distribution, wood waste handling and storage, electric power and compressed air distribution. Plant safety issues.

IE 351 Manufacturing Engineering. *Preqs: MAT 201, GC 101, IE 307. 3(2-3) F,S.* Analytical study and design of manufacturing processes. Emphasis on the economics capabilities, and productivity of various processes in manufacturing, on the interrelations of materials, processes, and design with various aspects of manufacturing, and on applications of new developments in manufacturing, such as numerical control, robotics, and flexible manufacturing systems. MITTAL, SANII, OGRADY

IE 352 Work Analysis and Design. *Preq: ST 361 or ST 371. 3(2 2) F.S.* Work methods and production processes to improve operator effectiveness and reduce production costs. Techniques studied include operation analysis, motion study, value engineering, predetermined time systems, time study and line balancing. SMITH

IE 361 Deterministic Models in Industrial Engineering. *Preq: MA 303 or MA 405. For IE, ECE, and CSC majors and IE minors only. 3(3 0) F.S.* Introduction to mathematical modeling, analysis techniques, and solution procedures applicable to decision making problems in a deterministic environment. Linear programming models and algorithms and associated computer codes are emphasized. FATHI, NUTTLE, BERNHARD

IE 371 Furniture Production and Inventory Systems. *Preqs: IE 307, ST 361; Coreq: IE 340. 3(2-3) F.* Forecasting, inventory control, production planning and scheduling, shop floor control. Organization of production control; use of computers. Examples from the furniture industry. CULBRETH

IE 401 Stochastic Models in Industrial Engineering. *Preqs: ST 371; MA 303 or MA 405. For IE, ECE, and CSC majors and IE minors only. 3(3 0) F.S.* Introduction to mathematical modeling, analysis, and solution procedures applicable to decision making problems in an uncertain (stochastic) environment. Methodologies covered include dynamic programming, simulation, Markov chains, and classical optimization. Applications relate to problems such as inventory control, waiting lines, and system reliability and maintainability. BERNHARD

IE 440 Furniture Management Analysis. *Preq: IE 311, IE 341, IE 371. 3(1 4) S.* Economic decision making applied to the furniture industry. Selection of equipment, materials, methods and strategy from several feasible alternatives studied with the aid of actual case histories.

IE (CSC) 441 Introduction to Simulation. *Preqs: MA 242, ST 372, programming proficiency. 3(3 0) F.* Discrete event stochastic simulation for the modeling and analysis of systems. Programming of simulation models in a simulation language. Input data analysis, variance reduction techniques, validation and verification, and analysis of simulation output. Random number generators and random variate generation. ROBERTS, WILSON, DAMERDTI

IE 443 Quality Control. *Preq: ST 361. 3(2 2) F.S., Sum.* Statistical methods in quality control; control charts for variables and attributes; inspection sampling plans and procedures. Industrial applications. MITTAL, SMITH

IE 452 Ergonomics. *Coreq: IE 352. For IE and FMM majors and IE minors only. 3(2 2) F.S.* Introduction to man-machine-environment systems design and evaluation; applications to consumer products, tools, equipment, and the workplace. Overview of ergonomic research methodologies. Consideration of man's anatomical, physiological, and psychological capabilities and limitations as related to systems design and human performance. Use of anthropometric data in design. Display and control systems design. Effects of environmental stress upon work performance, safety, and health. AYOUB

IE 453 Facilities Design. *Preqs: IE 351, IE 352. 3(2 2) F.S.* Principles and practice in layout and material handling planning for industrial/service facilities. Integration of product and process and functional design of facilities. Computer software to optimize economic objectives. Group projects. TREVINO

IE 472 Quantitative Methods in Furniture Manufacturing. *Preqs: IE 311; IE 340; IE 371. 4(3 2) S.* Quantitative methodologies for problem solving in furniture manufacturing operations. Deterministic and stochastic models, linear programming, decision theory, waiting line models, and computer simulation. Applications in resource allocation, production planning and control, project scheduling, systems analysis, and facilities design. Emphasis on computer based problem solving. CULBRETH

IE 495 Project Work in Industrial Engineering. *Preq: Jr. standing and consent of instructor. 1-6 F,S.* Special investigations, study or research related to the field of industrial engineering or furniture manufacturing and management. In a given semester several students and or student groups may be working in widely divergent areas under the direction of several members of the faculty.

IE 498 Senior Design Project. *Preqs: IE 308, 311, 441, 443, 452, 453.* For Industrial Engineering majors only. 3(3-0) F,S. Individual or group design projects requiring problem definition and analysis, synthesis, specification and presentation of a designed solution. Students work under faculty supervision either on actual industrial engineering problems posed by local industrial, service and governmental organization or on emerging research issues.

Selected 500-Level Courses Open To Advanced Undergraduates

IE (MA, OR) 505 Linear Programming. *Preq: MA 405, 3(3-0) F,S.*

IE (OR) 509 Dynamic Programming. *Preqs: MA 405, ST 421, 3(3-0) S.*

IE 511 Capital Investment Economic Analysis. *Preqs: IE 311, ST 371, 3(3-0) F.*

IE 512 Bayesian Decision Analysis for Engineers and Managers. *Preq: ST 371 or ST 421, 3(3-0) F.*

IE 515 Advanced Manufacturing Processes. *Preqs: IE 351 and EE 331 or equivalent, 3(3-0) F.*

IE 516 CAM I: A Systemic Approach to Computer Aided Manufacturing. *Preq: IE 351 or 485, 3(3-0) F.*

IE 518 Manufacturing Operations Management. *Preqs: MA 202 or MA 212; ST (EB) 350 or ST 372, 3(3-0) F.*

IE (MAE) 520 Industrial Robotics. *Preqs: IE 351 or 485; MA 301 or 303, 3(3-0) F.*

IE 521 Management Decision and Control Systems. *Preqs: IE 421, CSC 421 or equivalent, 3(3-0) S.*

IE 525 Organizational Planning and Control. *Preqs: Three credit hours in operations management (such as EB 325, IE 308), 3(3-0) S.*

IE (PSY) 540 Human Factors in Systems Design. *Preq: IE 452; Coreq: ST 507 or 515, 3(3-0) F.*

IE 541 Systems Safety Engineering. *Preqs: IE 452, ST 371, 3(3-0) S.*

IE 547 Reliability and Quality Assurance. *Preq: One of the following: IE 308, IE 371, ST 421 or ST 515, 3(3-0) S.*

IE 553 Materials Handling Systems. *Preq: IE 453, 3(3-0) S.*

IE 556 Industrial Logistics. *Preq: IE 453, 3(3-0) F.*

IE (OR) 561 Queues and Stochastic Service Systems. *Preq: MA 421, 3(3-0) F.*

IE (CSC, ECE) 575 Voice Input Output Communication Systems. *Preqs: MA 202 and IE 307 or CSC 312, 3(3-0) F.*

IE (MA, OR) 586 Network Flows. *Preq: IE (OR, MA) 505 or equivalent, 3(2-2) S.*

IE 589 Special Topics in Industrial Engineering. *Preq: Grad. or Sr. standing and CI 1-4*

LANDSCAPE ARCHITECTURE

(Also see DN Design)

LAR 221 Introduction to Environment and Behavior for Designers. 3(3-0) F. Integration of behavioral and environmental systems related to design. Exploration of humane, ecologically sound design alternatives. WOOD

LAR 222 Perception and Behavior for Designers. 3(3-0) S. Perceptual systems, link ages among them, and linkages between them and language and culture as these affect the design process. WOOD

LAR 234 Introduction to Environmental Design. *Not available for credit to design students except as free elective.* 3(2-4) S, Sum. An introduction to small-scale environmental design. Emphasis on drawing and modeling as ways of seeing and thinking about the environment and its development. Special attention is paid to the role of environmental factors (sun, water, soils, vegetation) in problem identification and solution.

LAR 292 Special Topics in Landscape Architecture. *Preq: Consent of instructor.* 1 3 F, S, Sum. Topics of current interest in Landscape Architecture. Normally used to develop new courses.

LAR 400 Landscape Architecture Studio. *Preq: DF 102 or written approval of department head and dean.* 6(0-9) F, S. Projects cover small scale design, urban landscapes, community design, and environmental management. Design process stressed, including attention to project organization, design synthesis and realization.

LAR 421 Environmental Cognition for Designers. 3(3-0) F. Basic cognitive theory as a framework for exploration of cognitive imagery; images of self; and developmental images of home, school, neighborhood, and city. WOOD

LAR 423 Concepts of Space. 3(3-0) F. The role of space and its representation in design is considered against an overview of concepts of space drawn from psychology, anthropology, mathematics, art history, and philosophy. WOOD

LAR 430 Site Planning. *Preqs: MEA 101 110 or MEA 120 110 or SSC 200.* 3(2-3) F. Technical operations and environmental landscape controls for site development. Site analysis, grading and drainage, earthwork, horizontal and vertical control for road alignment. Graphic exercises.

LAR 433 Native Plants in Environmental Design. 3(2-3) S. Analysis of natural processes relating to plant materials native to this region. Planting design theory. Planting design methods. Applications in a laboratory setting. ABBATE

LAR 443 Landscape History. 3(3-0) F. Human impact on the land over the past 20,000 years: development of agriculture, commerce and industry and their role in changing the face of the earth. WOOD

LAR 444 History of Landscape Architecture. 3(3-0) F, Alt. yrs. History of landscape architecture: precedent work of primitives, early Americans, oriental cultures, European Middle Ages and the Renaissance. Origins and development of the profession with emphasis on the work of Frederick Law Olmstead.

LAR 457 Landscape Construction Materials, Methods and Documentation. *Preq: LAR 430.* 3(2-3) S. Materials, standards, and construction methods used to implement landscape architectural designs. Development of construction documents.

LAR 492 Special Topics in Landscape Architecture. *Preq: Consent of instructor.* 1 3 F, S, Sum. Topics of current interest in Landscape Architecture. Normally used to develop new courses.

LAR 494 Internship in Landscape Architecture. *Preqs: Jr. standing in Landscape Architecture; 3.0 GPA or better; and written approval of department head.* Maximum of 6 credit hours. 3 6 F, S. Supervised field experience in landscape architecture offices and organizations.

LAR 495 Independent Study in Landscape Architecture. *Preqs: 3.0 GPA and Jr. standing. Maximum of 6 credit hours and approval of department head.* 1 3 F, S. Special projects in landscape architecture developed under the direction of a faculty member on a tutorial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

LAR 511 Community Design Policy. 3(3-0) F.

LAR 512 **Landscape Resource Management.** *Preq: DN 431 or CI 3(1 4) S.*

LAR 530 **Advanced Site Planning.** *Preqs: LAR 457, LAR 430, 3(2 2) S.*

LAR 533 **Plants and Design.** *3(2 2).*

LAR 564 **Management and Marketing Techniques in Community Design.** *3(3-0) S. All. grs.*

LATIN LANGUAGE AND LITERATURE

Not: All students with previous knowledge of French, German, Latin, or Spanish must take the placement test upon entering the University. They will be given advanced standing and receive credit according to their score.

LAT 101 **Elementary Latin I.** *3(3 0) F.* Beginning course in Classical Latin, emphasizing elementary grammatical form and basic syntax. Readings based on brief selections from Roman authors, including Cicero and Catullus.

LAT 102 **Elementary Latin II.** *Preq: LAT 101, 3(3 0) S.* A second course in Classical Latin, continuing and expanding the work of Latin 101. Completes study of grammar. Readings from a variety of Latin texts, in particular Livy Book I.

LAT 201 **Intermediate Latin I.** *Preq: LAT 102, 3(3 0) F.* Introduction to Latin prose and poetry. Emphasis on increased reading skill. Review of grammar fundamentals and exposure to new and more complex syntax. Examination of cultural significance of readings.

LAT 202 **Intermediate Latin II.** *Preq: LAT 201, 3(3 0) S.* Lyric poetry of Catullus and Horace emphasizing vocabulary, syntax, and techniques of Latin verse. Traditions and the evolution of lyric poetry and the social role of the Roman poet.

LAT (GRK) 310 **Classical Mythology.** *3(3 0) F.* (See Greek Language and Literature.)

MATHEMATICS

MA 101 **Basic Algebra.** *Credit for MA 101 is not allowed if student has prior credit in any other mathematical course. MA 101 may not be counted as credit toward meeting requirements. 4(5 0) F,S,Sum.* Preparation for MA 111 and MA 103. Basic concepts and skills of algebra including algebraic operations, factoring, linear equations, functions, graphs, exponents and radicals, complex numbers, quadratic equations, radical equations, inequalities.

MA 103 **Topics in Contemporary Mathematics.** *Preqs: MA 101 or equivalent completed in high school. Credit for MA 103 is not allowed if student has prior credit in MA 141, 131, 121 or 114. 3(3 0) F,S,Sum.* Primarily for students in Humanities and Social Sciences. Illustrations of contemporary uses of mathematics, varying from semester to semester, frequently including sets and logic, counting procedures, probability, modular arithmetic, and game theory.

MA 105 **Mathematics of Finance.** *Preq: MA 101 or equivalent completed in high school. 3(3 0) F,S,Sum.* Simple and compound interest, annuities and their application to amortization and sinking fund problems, installment buying, calculation of premiums of life annuities and life insurance.

MA 111 **Precalculus Algebra and Trigonometry.** *Preq: Placement via Level Two Achievement Test or MA 101. Credit in MA 111 does not count toward graduation for students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science Program), Biological Sciences (all options), Mathematics Education, Forestry, and Textiles. 3(3-1) F,S,Sum.* Real numbers, functions and their graphs (special attention to polynomial, rational, exponential, logarithmic, and trigonometric functions), analytic trigonometry.

MA 114 Introduction to Finite Mathematics with Applications. *Preq: MA 101 or equivalent completed in high school. 3(3 0) F, S, Sum.* Elementary matrix algebra - addition and multiplication, inverses, systems of linear equations; introduction to linear programming including simplex method; sets and counting techniques; elementary probability probability measures, conditional probability; Markov chains; applications in the behavioral, managerial and biological sciences.

MA 121 Elements of Calculus. *Preq: MA 111 or placement via Level Two Achievement Test. Credit is not allowed in more than one of MA 141, 131, 121. MA 121 may not be substituted for MA 141 as a curricular requirement. 4(4-1) F, S, Sum.* For students who require only a single semester of calculus. Emphasis on concepts and applications of calculus, along with basic skills. Algebra review, functions, graphs, limits, derivatives, integrals, logarithmic and exponential functions, functions of several variables, applications in biological and social sciences.

MA 131 Analytic Geometry and Calculus A. *Preq: MA 111 or placement via Level Two Achievement Test. Credit not allowed for more than one of MA 121, 131, and 141. 4(4 1) F,S,Sum.* Limits and derivatives; techniques of differentiation; applications of derivatives; logarithms, exponential and trigonometric functions; higher derivatives; definite integral and applications; integration techniques; examples and applications in biological and behavioral sciences and economics.

MA 141 Analytic Geometry and Calculus I. *Preq: MA 111 with grade of C or better or placement via Level Two Achievement Test. Credit is not allowed for more than one of MA 141, 131, 121. 4(4-1) F,S,Sum.* First of three semesters of unified analytic geometry and calculus sequence. Functions, graphs, limits, derivatives of algebraic and trigonometric functions, indefinite and definite integrals, fundamental plane analytic geometry.

MA 214 Elementary Probability. *Preq: MA 131, 121 or 141. 3(3 0) S.* Sample spaces, events, and probabilities; elementary counting procedures; conditional probability; discrete random variables - probability functions and expected values, normal random variables and density functions; examples and applications in biological, management, and behavioral sciences.

MA (CSC) 222 Applied Discrete Mathematics. *Preqs: CSC 101, MA 141. 3(3-0) F,S.* Formal logic. Methods of proof including induction. Introduction to grammars and finite state machines. Recurrence relations and asymptotic behavior of functions. Sets and counting. Boolean expressions and logic networks. Graphs and relations.

MA 225 Structure of the Real Number System. *Preq: MA 241. 3(3-0) F,S.* Introduction to mathematical proof with focus on properties of the real number system. Elementary symbolic logic, mathematical induction, algebra of sets, relations, functions, countability, algebraic and completeness properties of the reals with applications to elementary probability theory.

MA 231 Analytic Geometry and Calculus B. *Preq: MA 131. 3(3 0) F,S,Sum.* Multivariate calculus-partial derivatives, multiple integrals, applications; sequences, series, and Taylor's Theorem; differential equations; difference equations; examples and applications in biological and behavioral sciences and economics.

MA 241 Analytic Geometry and Calculus II. *Preq: MA 141 with grade of C or better. 4(4-1) F, S, Sum.* Second of three semesters of unified analytic geometry and calculus sequence. Differentiation and integration of exponential, logarithmic, and inverse trigonometric functions. Techniques of integration. Complex numbers. Elementary differential equations. Sequences, series, power series, and Taylor's Theorem.

MA 242 Analytic Geometry and Calculus III. *Preq: MA 241 with grade of C or better. 4(4-1) F,S,Sum.* Third of three semesters of unified analytic geometry and calculus sequence. Vectors and vector functions. Analytic geometry of three dimensional space. Functions of several variables, partial derivatives, gradients, directional derivatives, maxima and minima. Multiple integration. Line and surface integrals, Green's Theorem, Divergence Theorem.

MA 293 Special Topics in Mathematics. *Prq: Consent of Department Head. 1-6 F,S,Sum.* Freshman sophomore level experimental course offerings or directed individual study.

MA 301 Introduction to Differential Equations. *Prqs: Credit for 12 hours of calculus; primarily intended for transfer students whose calculus backgrounds do not include a study of first and second order linear differential equations. Credit not allowed if MA 241 taken previously at NCSU. 3(3-0) F,S.* First order differential equations with applications; second order linear differential equations with applications in mechanics and other areas; elementary matrix algebra, systems of linear equations and applications; Laplace transforms; Fourier series.

MA 302 Numerical Applications to Differential Equations. *Prq: CSC 101 or CSC 111; Coreq: MA 241. 1(1-0) F,S.* Several numerical methods for obtaining approximate solutions for differential equations. Included are series and Runge Kutta methods. Applications made to problems involving systems of non-linear differential equations.

MA 303 Linear Analysis. *Prq: MA 241. Credit not allowed if credit has been obtained for MA 301, 341 or 405. 3(3-0) F,S.* Linear difference equations of first and second order, compound interest and amortization. Matrices and systems of linear equations, eigen values, diagonalization, systems of difference and differential equations, transform methods, population problems.

MA 305 Elementary Linear Algebra. *Prqs: MA 242 or MA 231. CSC 101 or CSC 111. Credit is not allowed for both MA 305 and MA 405. 3(3-0) F,S.* An elementary introduction to the essentials of linear algebra. Matrices and systems of linear equations, determinants, Euclidean spaces as vector spaces, linear transformations of euclidean spaces, elementary treatment of eigenvalues and eigenvectors, applications to numerical solutions of equations and computer graphics.

MA 314 Probability with Applications to Electrical and Computer Engineering. *Prq: MA 242. Credit for both MA 314 and MA 421 is not allowed. 3(3-0) F,S.* Fundamentals of discrete and continuous probability: conditional probability, independence, random variables, density and distribution functions, expected value and variance, common discrete and continuous distributions, joint distributions, and introduction to simple stochastic processes. Applications to electrical engineering; reliability of series and parallel circuits, models for waiting time phenomena.

MA 341 Applied Differential Equations I. *Prq: MA 242. Credit is not allowed for both MA 301 and MA 341. 3(3-0) F,S,Sum.* Differential equations and systems of differential equations. Methods for solving ordinary differential equations including Laplace transforms, power series, and numerical methods. Matrix techniques for systems of linear ordinary differential equations. Fourier series and introduction to the heat equation.

MA 351 Introduction to Discrete Mathematical Models. *Prq: MA 214, 222, 231 or 241. 3(3-0) F,S.* Basic concepts of discrete mathematics, including graph theory, Markov chains, game theory, with emphasis on applications; problems and models from areas such as traffic flow, genetics, population growth, economics, and ecosystem analysis.

MA 401 Applied Differential Equations II. *Prq: MA 341 or 301. Credit for both MA 401 and MA 501 will not be given. 3(3-0) F,S,Sum.* Wave, heat and Laplace equations. Solutions by separation of variables and expansion in Fourier Series or other appropriate orthogonal sets. Sturm-Liouville problems. Introduction to methods for solving some classical partial differential equations. Use of power series as a tool in solving ordinary differential equations.

MA 403 Introduction to Modern Algebra. *Prq: MA 225 or MA (CSC) 222. Credit is not allowed for both MA 403 and MA 407. 3(3-0) F,S,Sum.* Sets and mappings, equivalence relations, rings, integral domains, ordered integral domains, ring of integers. Other topics selected from fields, polynomial rings, real and complex numbers, groups, permutation groups, ideals, and quotient rings.

- MA 405 Introduction to Linear Algebra and Matrices.** *Prereq:* MA 241; *Coreq:* MA 242. *Credit is not allowed for both MA 305 and MA 405. 3(3-0) F,S,Sum.* Linear equations operations with matrices, row echelon form, determinants, vector spaces, linear independence, bases, dimension, orthogonality, eigenvalues, reduction of matrices to diagonal forms, applications to differential equations and quadratic forms.
- MA 407 Introduction to Modern Algebra for Mathematics Majors.** *Prereq:* MA 225. *Credit is not allowed for both MA 403 and MA 407.* Elementary number theory, equivalence relations, groups, homomorphisms, cosets, Cayley's Theorem, symmetric groups, rings, polynomial rings, quotient fields, principal ideal domains, Euclidean domains.
- MA 408 Foundations of Euclidean Geometry.** *Prereq:* MA 225 or MA (CSC) 322, 3(3-0)S. A critique of Euclid's Elements, incidence and order properties, congruence of triangles absolute and non-Euclidean geometry, the parallel postulate, real numbers and geometry.
- MA 410 Theory of Numbers.** *Prereq:* *One year of calculus. 3(3-0)S.* Arithmetic properties of integers. Congruences, arithmetic functions, diophantine equations. Other topics chosen from quadratic residues, the quadratic reciprocity Law of Gauss, primitive roots, and algebraic number fields.
- MA 414 Introduction to Differential Geometry.** *Prereqs:* MA 242 and MA 405. 3(3-0)S. Introduction to the geometry of curves and surfaces from a modern point of view: calculus in Euclidean spaces, differential forms, calculus on surfaces as manifolds, integration of forms, curvatures, isometries, orientations, geodesics.
- MA (CSC) 416 Introduction to Combinatorics.** *Prereqs:* MA 242 and proficiency in a programming language. 3(3-0) S. *Alt. yrs.* Problems of enumeration, distribution and arrangement, inclusion-exclusion principle, recurrence relations, generating functions, difference equations, combinatorial identities, graphs, trees, digraphs, systems of distinct representatives, matching problems, and optimization. Applications from computer science, operations research, and natural sciences.
- MA 421 Introduction to Probability.** *Prereq:* MA 242 or MA 231. *Credit for both MA 421 and MA 314 is not allowed. 3(3-0) F,S,Sum.* Axioms of probability, conditional probability, combinatorial analysis, random variables, expectation, simple stochastic processes.
- MA 425 Mathematical Analysis I.** *Prereq:* MA 242 (407 desirable), 3(3-0) F,S. Real number system, functions and limits, topology on the real line, continuity, differential and integral calculus for functions of one variable. Infinite series, uniform convergence.
- MA 426 Mathematical Analysis II.** *Prereqs:* MA 425 and 405. 3(3-0)S. Calculus of several variables, topology in n dimensions, limits, continuity, differentiability, implicit functions, integration.
- MA (CSC) 427 Introduction to Numerical Analysis I.** *Prereqs:* MA 341 or 301 and programming language efficiency. 3(3-0) F. Theory and practice of computational procedures using a digital computer, including approximation of functions by interpolating polynomials, numerical differentiation and integration, and solution of ordinary differential equations including both initial value and boundary value problems. Computer applications and techniques.
- MA (CSC) 428 Introduction to Numerical Analysis II.** *Prereqs:* MA 405 and programming language proficiency. MA (CSC) 427 is not a prerequisite. 3(3-0) S. Computational procedures using digital computers. Solution of linear and nonlinear equations, matrices and eigenvalue calculations, curve fitting and function approximation by least squares, smoothing functions, and minimax approximations.
- MA 430 Mathematical Models in the Physical Sciences.** *Prereqs:* MA 341 or 301; and MA 405. 3(3-0) F. Application of mathematical techniques to topics in the physical sciences. Problems from such areas as conservative and dissipative dynamics, calculus of variations, control theory, and crystallography.

MA 432 Mathematical Models in Life and Social Sciences. *Preqs: MA 301 or 341, 305 or 405., programming language proficiency. Coreq: MA 421 or ST 371. 3(3-0) S.* Topics from differential and difference equations, probability, and matrix algebra applied to formulation and analysis of mathematical models in biological and social science (e.g., population growth).

MA 433 History of Mathematics. *Preq: One year of calculus. 3(3-0) F,S.* Development of mathematical thought and evolution of mathematical ideas examined in a historical setting. Biographical and historical content supplemented and reinforced by study of techniques and procedures used in earlier eras.

MA 437 Applications of Algebra. *Preq: MA 403 or 407, MA 405. 3(3 0) S.* Error correcting codes, cryptography, crystallography, enumeration techniques, exact solutions of linear equations, and block designs.

MA 491 Reading in Honors Mathematics. *Preq: Membership in honors program, consent of department. 2 n F,S.* A reading (independent study) course available as an elective for students participating in the mathematics honors program.

MA 493 Special Topics in Mathematics. *Preq: Consent of department. 1 6.* Directed individual study or experimental course offerings.

Selected 500-Level Courses Open To Advanced Undergraduates

MA 501 Advanced Mathematics for Engineers and Scientists I. *Preq: MA 341 or 301 or this course and MA 401 is not allowed. 3(3 0) F,S,Sum.*

MA 502 Advanced Mathematics for Engineers and Scientists II. *Preq: MA 341 or 301 or equivalent. Any student receiving credit for MA 502 may receive credit for, at most, one of the following: MA 405, MA 512, MA 513. 3(3 0) F,S,Sum.*

MA (OR) 504 Introduction to Mathematical Programming. *Preq: MA 242, 405. 3(3-0) S.*

MA (IE, OR) 505 Linear Programming. *Preq: MA 405. 3(3 0) F,S.*

MA 511 Advanced Calculus I. *Preq: MA 341 or 301. May not be taken for credit by undergrad. mathematics majors. 3(3-0) F,S,Sum.*

MA 512 Advanced Calculus II. *Preq: MA 341 or 301. 3(3 0) F,S,Sum.*

MA 513 Introduction to Complex Variables. *Preq: MA 242 (202). 3(3-0) F,S,Sum.*

MA 514 Methods of Applied Mathematics. *Preq: MA 511 or 425. 3(3-0) S.*

MA 515 Linear Functional Analysis I. *Preq: MA 426. 3(3 0) F.*

MA 517 Introduction to Topology. *Preq: MA 426. 3(3-0) F.*

MA 518 Calculus on Manifolds. *Preq: MA 426. 3(3 0) S.*

MA 520 Linear Algebra. *Preq: MA 405. 3(3 0) F.*

MA (E, OR) 531 Dynamical Systems and Multivariable Control. *Preqs: MA 341 or 301, 405 or equivalent. 3(3-0) F.*

MA 532 Theory of Ordinary Differential Equations. *Preqs: MA 341 or 301, 405, advanced calculus. 3(3 0) S.*

MA 534 Introduction to Partial Differential Equations. *Preqs: MA 425 or MA 511, MA 341 or 301. 3(3 0) F.*

MA (ST) 541 Theory of Probability I. *Preq: MA 425 or 511. 3(3 0) F,Sum.*

MA 544 Computer Experiments in Mathematical Probability. *Preq: MA 421. 3(3-0) S.*

MA 545 Set Theory and Foundations of Mathematics. *Preq: MA 403. 3(3-0) S.*

MA (PY) 555 Mathematical Introduction to Celestial Mechanics. *Preq: MA 341 or 301. 3(3 0) F.*

MA (PY) 556 Orbital Mechanics. *Preqs: MA 341 or 301, 405, knowledge of elementary mechanics and computer programming. 3(3-0) S.*

MA (BMA, ST) 571 Biomathematics I. *Preq: Advanced calculus, reasonable background in biology or CI. 3(3 0) F.*

MA 581 Special Topics. *Preq: Consent of department. 1-6 F,S.*

MA (CSC) 583 Numerical Solution of Ordinary Differential Equations. *Preq: Knowledge to the level of CSC 427. 3(3-0) S.*

MA (CSC, OR) 585 Graph Theory. *Preq: MA 405. 3(3 0) F.*

MECHANICAL AND AEROSPACE ENGINEERING

MAE 206 Engineering Statics. *Preq: PY 205; Coreq: MA 242. 3(3 0) F,S,Sum.* Basic concepts of forces in equilibrium. Distributed forces, frictional forces. Inertial properties. Application to machines, structures, and systems.

MAE 208 Engineering Dynamics. *Preq: MAE 206 or CE 214, MA 242. 3(3-0) F,S,Sum.* Kinematics and kinetics of particles in rectangular, cylindrical, and curvilinear coordinate systems; energy and momentum methods for particles; kinetics of systems of particles; kinematics and kinetics of rigid bodies in two and three dimensions; motion relative to rotating coordinate systems.

MAE 261 Aerospace Vehicle Performance. *Preqs: MA 241, PY 205. 3(3-0) S,Sum.* Introduction to the problem of performance analysis in aerospace engineering. Aircraft performance in gliding, climbing, level and turning flight. Calculation of vehicle take-off and landing distance, range and endurance.

MAE 301 Engineering Thermodynamics I. *Preqs: MA 242, PY 208 or 202. 3(3 0) F,S,Sum.* Introduction to the concept of energy and the laws governing the transfers and transformations of energy. Emphasis on thermodynamic properties and the First and Second Law analysis of systems and control volumes. Integration of these concepts into the analysis of basic power cycles introduced.

MAE 302 Engineering Thermodynamics II. *Preq: C or better in MAE 301, CSC 112. 3(3 0) F,S,Sum.* Continuation of Engineering Thermodynamics I with emphasis on the analysis of power and refrigeration cycles and the application of basic principles to engineering problems with systems involving mixtures of ideal gases psychrometrics, nonideal gases, chemical reactions, combustion, chemical equilibrium cycle analysis and one-dimensional compressible flow.

MAE 305 Mechanical Engineering Laboratory I. *Preq: Junior standing in ME. 1(0-3) F,Sum.* Theory and practice of measurement and experimental data collection. Laboratory evaluation and demonstration of components of the generalized measurement system and their effects on the final result. Applications of basic methods of data analysis as well as basic instrumentation for sensing, conditioning and displaying experimental qualities.

MAE 306 Mechanical Engineering Laboratory II. *Preq: MAE 305. 1(0-3) S,Sum.* Continuation of MAE 305 into specific types of measurements. Students evaluate and compare different types of instrumentation for measuring the same physical quantity on the basis of cost, time required, accuracy, etc.

MAE 308 Fluid Mechanics. *Preqs: MA 242; MAE 208 or CE 215 or CE 213; CSC 112 or 101; Coreqs: MA 341, MAE 301. 3(3 0) F,S,Sum.* Development of the basic equations of fluid mechanics in general and specialized form. Application to a variety of topics including fluid statics, inviscid, incompressible fluid flow; and viscous, incompressible fluid flow.

MAE 310 Conduction and Radiation Heat Transfer. *Preqs: CSC 112, MA 341. C or better in MAE 301. 3(3-0) F,S,Sum.* Analysis of steady state and transient one and multi-dimensional heat transfer by conduction, employing both analytical methods and numerical techniques. Heat transfer by the mechanism of radiation.

- MAE 314 Solid Mechanics.** *Preqs: MAE 206, CE 213 or CE 214, MA 242; Coreq: MAT 201, 3(3-0) F,S,Sum.* Concepts and theories of internal force, stress, strain, and strength of structural element under static loading conditions. Constitutive behavior for linear elastic structures. Deflection and stress analysis procedures for bars, beams, and shafts. Introduction to matrix analysis of structures.
- MAE 315 Dynamics of Machines.** *Preqs: MAE 208, CSC 112; Coreq: MA 341; and a ME, AE major, 3(3-0) F,S,Sum.* Application of dynamics to the analysis and design of machine and mechanical components. Motions resulting from applied loads, and the forces required to produce specified motions. Introduction to mechanical vibration, free and forced response of discrete and continuous systems.
- MAE 316 Strength of Mechanical Components.** *Preq: MAE 314, CSC 112. Coreq: MA 341; and a ME, AE, NE major, 3(3-0) F,S,Sum.* Analysis and design of mechanical components based on deflection, material, static strength and fatigue requirements. Typical components include beams, shafts, pressure vessels and bolted and welded joints. Classical and modern analysis and design techniques. Computer analysis using the finite element method. Material and manufacturing considerations in design.
- MAE 355 Aerodynamics I.** *Preqs: MAE 261, MA 341, 3(3-0) F.* Fundamentals of perfect fluid theory with applications to incompressible flows over airfoils, wings, and flight vehicle configurations.
- MAE 356 Aerodynamics II.** *Preqs: MAE 355 and a grade of C or better in MAE 301, 3(3-0) S.* Concepts of thermodynamics, compressible fluid flow, and shock waves with application to computing the aerodynamic characteristics of airfoils, wings and flight configurations at high speed.
- MAE 357 Aerodynamics I Laboratory.** *Preqs: MAE 261, MA 341; Coreq: MAE 355, 1(0-3) F.* Introduction to the subsonic wind tunnel, instrumentation techniques for performing experiments, and reporting of information. Experiments involve pressure and force measurements on complete, and components of, aerospace vehicles.
- MAE 358 Aerodynamics II Laboratory.** *Preq: MAE 357; Coreq: MAE 356, 1(0-3) S.* Introduction to the supersonic wind tunnel, instrumentation techniques for performing experiments, and reporting of information. Experiments involve pressure and force measurements on supersonic configurations.
- MAE 365 Propulsion I.** *Preqs: MAE 355 and a grade of C of better in MAE 301, 3(3-0) S.* One dimensional internal flow of compressible fluids including: isentropic flow, normal shocks, flow with friction, simple heat addition. Applications to air breathing aircraft propulsion systems and overall performance of air-breathing engines.
- MAE 371 Aerospace Structures I.** *Preqs: MAE 261, MAE 314, 3(3-0) F.* Determination of appropriate analysis techniques for aerospace structures. Introduction of governing equations and selected solutions for typical structures. Use of these concepts in the design of a representative structural component.
- MAE 403 Air Conditioning.** *Preq: MAE 302, 3(3-0) F.* Fundamentals involved in the design of summer and winter air conditioning systems. Psychrometrics; load calculations; piping arrangements and sizing; duct layout and sizing; energy sources and diseminators; performance and selection of pumps and fans.
- MAE 404 Refrigeration.** *Preq: MAE 302, 3(3-0) S.* Thermodynamic analysis of the vapor compression cycle; optimization of multiple evaporator and multiple compressor systems; commercial refrigeration load calculations; desirable properties of refrigerants and brines, piping arrangement and sizing.
- MAE 405 Mechanical Engineering Laboratory III.** *Preq: MAE 306, 1(0-3) F,S.* Final undergraduate course in mechanical engineering laboratory sequence. Experimental investigation of measurement problems involving typical mechanical engineering equipment systems. Design and application of a measurement system to a specific problem.

MAE 406 Energy Conservation in Industry. *Prereq: MAE 302 and MAE 310. 3(3-0) F.* Application of energy conservation principles to broad range of industrial situations with emphasis on typical equipment encountered in plant engineering: boilers, insulation, cogeneration, industrial exhaust systems, heat recovery, steam traps, electrical energy usage. Field trip to view equipment and use of instrumentation on the boilers at the three power plants on NCSU campus.

MAE 407 Steam and Gas Turbines. *Prereqs: MAE 302; 308 or MAE 355. 3(3-0) S.* Fundamental analysis of the theory and design of turbo machinery flow passages; control and performance of turbomachinery; gas-turbine engine processes.

MAE 408 Internal Combustion Engine Fundamentals. *Prereq: MAE 302. 3(3-0) F.* Fundamentals common to internal combustion engine cycles of operation. Otto engine: carburetion, combustion, knock, exhaust emissions and engine characteristics. Diesel engine: fuel metering, combustion, knock, and performance. Conventional and alternative fuels used in internal combustion engines.

MAE 410 Convective Heat Transfer and Fluid Flow. *Prereqs: MAE 301, MAE 308; Coreq: MAE 310. 3(3-0) F, S, Sum.* Integration of principles and concepts of thermodynamics, fluid mechanics, and heat transfer to the development of practical convective heat transfer and mass transport relations relevant to mechanical engineering. Typical applications include boilers, condensers, piping, pumps, and heat exchangers.

MAE 411 Machine Component Design. *Prereqs: MAE 315, MAE 316. 3(3-0) F.* Application of the principles of solid mechanics and material science to the analysis and design of specific machine components including screws, bearings, gears, transmission devices, brakes, clutches, couplings, fly wheels, cams, etc.

MAE 412 Analysis and Design of Energy Systems. *Prereqs: MAE 302, MAE 310 and senior standing in MAE Coreq: MAE 410. 3(3-0) F, S.* Applications of thermodynamics, fluid mechanics, and heat transfer to energy systems with emphasis on design and computer modeling. Analyses of compressible flow and combustion. Design of heat exchangers and other power system components. Economic analyses and design optimization. Operating characteristics of gas turbines, diesel engines, and central power stations. Environmental impact of power generation. Nuclear fuels and nuclear plant components.

MAE 415 Analysis for Mechanical Engineering Analysis. *Prereqs: MAE 302, 308, 310, 315, 316, ECE 331, and senior standing in ME. 3(3-0) F, S.* Integration of the physical sciences, mathematics, and engineering to solve real world design problems. Emphasis on open ended problems which contain superfluous information and/or insufficient data. Solution techniques focus on problem definition, reduction to a solvable system, and development of a design response. Formal written communication of results.

MAE 416 Mechanical Engineering Design. *Prereqs: MAE 302, 308, 310, 315, 316, ECE 331, and senior standing in ME. 4(3-2) F, S.* Application of engineering principles to design and construction of a prototype by a team of students in response to a specific need. Emphasis on the design process: problem definition, establishment of objectives, generation of alternatives, preliminary design, detailed design, fabrication and testing of the prototype in the shop. Oral and written report of the project.

MAE 421 Principles of Solar Engineering. *Prereqs: A grade of C or better in MAE 301, MAE 308, senior standing in engineering. 3(3-0) S.* Principles of solar radiation, heat transfer and fluid mechanics as applied to the utilization of solar energy. A study of active and passive systems, thermal storage and energy conversion devices. Component and system design for active and passive systems along with methodologies for economic evaluation.

MAE 435 Principles of Automatic Control. *Prereq: MA 341. 3(3-0) F, S.* Study of linear feedback control systems using transfer functions. Transient and steady-state responses. Stability and dynamic analyses using time response and frequency response techniques. Compensation methods. Classical control theory techniques for determination and modification of the dynamic response of a system. Synthesis and design applications to typical mechanical engineering control systems. Introduction to modern control theory.

MAE 442 Automotive Engineering. *Preq: Senior in MAE. 3(3 0)* S. Fundamental aspects of automotive engineering. Examines various automotive systems (engine, brakes, etc.) as well as their interactions in such areas as safety and performance. Current practices and development for the future.

MAE 452 Aerodynamics of V STOL Vehicles. *Preq: MAE 356. 3(3 0)*. Introduction to the aerodynamics and performance of vertical and short take-off and landing vehicles. High lift devices. The aerodynamics of propellers and rotors. Helicopter aerodynamics.

MAE 453 Introduction to Space Flight. *Preq: PY 205; MA 341 or MA 303. 3(3-0) F*. Fundamental aspects of space flight: applications of two body orbital mechanics including earth satellites, orbital and interplanetary transfers and velocity budgets; the solar-system; propulsion system characteristics; space vehicle and booster performance, sizing, and staging; and atmospheric reentry.

MAE 455 Boundary Layer Theory. *Preq: MAE 355. 3(3 0) F*. Introduction to the Navier-Stokes Equations and boundary layer approximations for incompressible flow. Calculation techniques for laminar and turbulent boundary layer parameters which affect lift, drag, and heat transfer on aerospace vehicles. Discussions of compressible flows.

MAE 456 Computational Methods in Aerodynamics. *Preqs: CSC 302 and MAE 455. 3(3 0) Alt. S*. Introduction to computational methods for solving exact fluid equations. Emphasis on development of the fundamentals of finite difference methods and their application to viscous and inviscid flows.

MAE 461 Dynamics & Controls. *Preq: MA 341, MAE 208. 3(3-0) S*. Dynamics and linear feedback control of aerospace and mechanical systems. Concepts from linear system theory, kinematics, particle dynamics, first and second-order systems, system dynamics, vibrations, and computational techniques. Feedback control by root-locus, Nyquist, Bode plots, servo-mechanisms, gain and phase margin, and compensation. Control system design emphasized.

MAE 462 Flight Vehicle Stability and Control. *Preqs: MAE 261, 461. 3(3 0) F*. Longitudinal, directional and lateral static stability and control of aerospace vehicles. Linearized dynamic analysis of the motion of a six degree-of-freedom flight vehicle in response to control inputs and disturbance through use of the transfer function concept. Control of static and dynamic behavior by vehicle design (stability derivatives) and/or flight control systems.

MAE 465 Propulsion II. *Preq: MAE 365. 3(3 0) F*. Performance analysis and design of components and complete air breathing propulsion systems.

MAE 466 Propulsion II Laboratory. *Preqs: MAE 365, MAE 357, Coreq: MAE 465 1(0 3) F*. Laboratory work in the material covered in MAE 365 and MAE 465.

MAE 472 Aerospace Vehicle Structures II. *Preq: MAE 371. 3(3 0) S*. A continuation of MAE 371; deflection of structures, indeterminate structures, minimum weight design fatigue analysis and use of matrix methods in structural analysis. Selection of materials for aircraft construction based on mechanical, physical, and chemical properties.

MAE 473 Aerospace Vehicle Structures II Lab. *Preq: MAE 371; Coreq: MAE 472. 1(0-3) S*. Demonstration and application of the concepts that have been presented in MAE 371 and MAE 472. Fabrication techniques and the design and construction of a structural component will be emphasized.

MAE 478 Aerospace Vehicle Design I. *Preqs: MAE 356, 472, senior standing in AE; Coreqs: MAE 462, 465. Available only to seniors in the Aerospace Engineering Curriculum. 3(1 3) F*. A synthesis of previously acquired theoretical and empirical knowledge and application to the design of practical aerospace vehicle systems.

MAE 479 Aerospace Vehicle Design II. *Preq: MAE 478. 3(1-6) S*. A continuation of MAE 478. Alternate designs analyzed to determine a near optimal one which best satisfies the mission requirements. Detail design performed on major components of the vehicle system.

- MAE 495 Special Topics in Mechanical and Aerospace Engineering.** *Preq: Consent of instructor. 1-3 F,S,Sum. Offered as needed to present new or special MAE subject matter.*
- Selected 500-Level Courses Open To Advanced Undergraduates**
- MAE 501 Advanced Engineering Thermodynamics.** *Preqs: MAE 302, MA 401 or MA 511. 3(3-0) F.*
- MAE 503 Advanced Power Plants.** *Preq: MAE 412. 3(3-0) F.*
- MAE 504 Fluid Dynamics of Combustion I.** *Preqs: MAE 301, MAE 355 or MAE 306.*
- MAE 505 Heat Transfer Theory and Applications.** *Preq: MAE 410 or equivalent. 3(3-0) F.*
- MAE 506 Advanced Automotive Energy Systems.** *Preq: MAE 408. 3(3-0) S.*
- MAE 510 Effects of Noise and Vibration on Man.** *Preqs: Sr. standing in Engineering, MA 341. 3(3-0) Alt. F.*
- MAE 513 Vibration of Mechanical and Structural Components.** *Preq: MAE 315 or 472. 3(3-0) F.*
- MAE 514 Industrial Noise Control.** *Preq: MAE 315. 3(2-3) S.*
- MAE 517 Instrumentation in Sound and Vibration Engineering.** *Preq: ECE 331; Coreq: MAE 513. 3(3-0) S.*
- MAE 518 Acoustic Radiation I.** *Preqs: MA 341 and MAE 308 or MAE 356. 3(3-0) F.*
- MAE (IE) 520 Industrial Robotics.** *Preqs: IE 351 or 485; MA 341 or 303. 3(3-0) F.*
- MAE 525 Advanced Flight Vehicle Stability and Control.** *Preq: MAE 462. 3(3-0) F.*
- MAE 526 Inertial Navigation Analysis and Design.** *Preq: MAE 461 or 462. 3(3-0) S.*
- MAE (MAT) 531 Materials Processing by Deformation.** *Preq: Six hours of solid mechanics and/or materials. 3(3-0) F.*
- MAE (MAT) 532 Fundamentals of Metal Machining Theory.** *Preq: Six hours of solid mechanics and/or materials. 3(3-0) S.*
- MAE 533 Finite Element Analysis of Mechanical and Aeronautical Systems I.** *Preq: MAE 316 or MAE 472. 3(3-0) F.*
- MAE 536 Photoelasticity.** *Preq: MAE 316 or 371. 3(2-3) S. Alt. yrs.*
- MAE 540 Advanced Air Conditioning Design.** *Preqs: MAE 403, 404. 3(3-0) S.*
- MAE 541 Advanced Machine Design I.** *Preq: MAE 416. 3(3-0) F.*
- MAE 542 Mechanical Design for Automated Assembly.** *Preq: Grad. standing or PBS status in engineering. 3(3-0) F.*
- MAE 543 Fracture Mechanics.** *Preq: MAE 316. 3(3-0) S.*
- MAE 544 Real Time Robotics.** *Preq: Pascal, C, Fortran or Assembly language experience. 3(3-0) F.*
- MAE 550 Foundations of Fluid Dynamics.** *Preqs: MAE 301, MAE 355 or MAE 308. 3(3-0) F.*
- MAE 551 Airfoil Theory.** *Preq: MAE 355. 3(3-0) S.*
- MAE 552 Transonic Aerodynamics.** *Preq: MAE 356. 3(3-0) S.*
- MAE 553 Compressible Fluids.** *Preq: MAE 356 or MAE 550. 3(3-0) Alt. F.*
- MAE 554 Hypersonic Aerodynamics.** *Preq: MAE 356. 3(3-0) F.*
- MAE 555 Aerodynamic Heating.** *Preq: MAE 356. 3(3-0) F.*
- MAE 556 Mechanics of Ideal Fluids.** *Preq: MAE 355 or MAE 308. 3(3-0) S.*
- MAE 557 Dynamics of Internal Fluid Flow.** *Preq: MAE 356 or MAE 308. 3(3-0) F.*

- MAE 558** **Plasmagasdynamics I.** *Preqs: MAE 356, PY 414, 3(3-0) F.*
- MAE 559** **Molecular Gas Dynamics I.** *Preq: MAE 550, 3(3-0) F.*
- MAE 560** **Computational Fluid Mechanics and Heat Transfer.** *Preqs: MA 501 or 512, MAE 550 or 557, 3(3 0) S.*
- MAE 561** **Wing Theory.** *Preq: MAE 551, 3(3-0) S. Alt. yrs.*
- MAE 562** **Physical Gas Dynamics.** *Preq: MAE 550, 3(3 0) F.*
- MAE 586** **Project Work in Mechanical Engineering.** *1-6 F.S.*
- MAE 589** **Special Topics in Mechanical Engineering.** *Preq: Advanced undergrad. or grad. standing, 3(3 0) F.S.*

MATERIALS SCIENCE AND ENGINEERING

MAT 200 **Mechanical Properties of Structural Materials.** *Preqs: CH 101 and the first course in engineering mechanics. Not for Materials Science and Engineering majors, 3(2 3) F.S.* An introduction to the atomic and grain structure of structural materials and their properties with emphasis on mechanical properties of metals; plastic deformation, cold and hot working and heat treatment of metals and alloys; residual stresses, fatigue, creep and corrosion phenomena; structural polymers and composites; physical examination and non-destructive testing of materials and structural components.

MAT 201 **Structure and Properties of Engineering Materials.** *Preq: CH 101, 3(3-0) F.S.* Introduction to the fundamental physical principles governing the structure and constitution of metallic and nonmetallic materials and the relationships among these principles and the mechanical, physical and chemical properties of engineering materials.

MAT 210 **Experiments in Materials Engineering.** *Coreq: MAT 201, 1(0 3) F.S.* Experiments designed to familiarize students with techniques of materials examination and demonstrate basic principles of materials behavior.

MAT 301 **Equilibrium and Rate Processes.** *Coreqs: MA 241; MAT 201, 3(3 0) S.* Application of thermodynamic and kinetic principles to engineering materials in the liquid and solid states. GLASS

MAT 311 **Ceramic Processing I.** *Preq: MAT 201, 435, 3(2 1) S.* Science and technology of ceramic raw materials; formulations; particle size reduction, separation and characterization; particle packing, mixing, blending and agglomeration; surface properties; rheology of liquid solid and solid-polymer systems; and forming processes. Process requirements for different ceramic raw materials and formulations.

MAT 321 **Phase Transformations and Diffusion.** *Preq: MAT 330, 3(3 0) S.* Types, mechanisms, and kinetics of solid state phase transformations are presented with selected applications of solid state transformations and correlations of phases with properties of materials. Mechanism of diffusion and techniques for diffusion calculations.

MAT 324 **Polymer Characterization Laboratory.** *Coreq: MAT 325, 1(0-3) F.* Polymer synthesis, molecular weight measurement, microscopic examination of polymers, measurement of thermal and mechanical properties, swelling, and permeability. BALIK

MAT (CHE) 325 **Introduction to Polymeric Materials.** *Preqs: CH 107, MAT 301; Coreq: MAT 324, 4(4-0) F.* Fundamental concepts in polymer science and engineering including: polymer chemistry, synthesis, physical structure, morphology, structure-property relationships, mechanical and thermal behavior, processing, and applications. BALIK

MAT 330 **Principles of Materials I.** *Preq: MAT 301, 3(3-0) F.* Structure of engineering materials from electronic to atomic and crystallographic considerations. Structural imperfections and their effects on properties. Applications of thermodynamic principles to the construction and use of phase diagrams in materials systems. Development of and correlation of microstructure with phase diagrams. PORTER

MAT 331 Principles of Materials II. *Preq: MAT 330. 3(3 0) S.* Electrical and magnetic properties of those structures studied in Principles of Materials I including dielectric, piezoelectric, ferromagnetic, and ferrimagnetic (ferrites) behavior; interactions of electromagnetic radiation with engineering materials; thermal properties, optical properties, luminescence. RUSSELL

MAT 332 Principles of Materials III. *Preqs: MAT 321 and 331. 3(3 0) F.* Practical methods for making quantitative estimates of changes in materials properties due to changes in composition, structure, and local environment. Metallic, ceramic, polymeric and electronic bulk materials and materials surfaces are treated. The use of computer modeling.

MAT 400 Metallic Materials in Engineering Design. *Preq: MAT 200 or 201. Not acceptable for MTE students. 3(3 0) F, S.* Relationship of microstructure to the properties of materials. Control of microstructure to meet engineering design requirements.

MAT (NE) 409 Nuclear Materials. *Preq: MAT 201. 2(2 0) S.* Materials used in nuclear reactors-pertinent factors in selection and utilization of the materials, and the effects of radiation on their physical, chemical and mechanical properties. MURTY

MAT 410 Computer Applications for Materials Engineering. *Preqs: CSC 111; Coreq: MAT 330. 3(3-0) F.* Computer techniques for processing materials data and performing materials design and analysis calculations.

MAT 423 Introduction to Materials Engineering Design. *Preq: MAT 435, 434, 450 and senior standing in MTE; Coreq: MAT 431, MAT 430. 3(3-0) F.* Problem solving in materials engineering design through effective utilizations of statistics, computer graphics, spreadsheets, and other tools of the trade. Through participatory involvement in modular design syntheses and analyses, provides broad exposure to engineering design issues; special emphasis on materials selections, relevant process sensitivities, and resultant end-use properties. First of two courses in materials engineering design to be followed by MAT 424.

MAT 424 Materials Science and Engineering Design Project. *Preq: MAT 423, 430, 431, 435, 434, 450 and senior standing. 3(1 6) S.* Design project in materials science and engineering requiring problem definition and analysis, synthesis, and presentation of a designed solution. Students work in groups with a faculty adviser on problems submitted by local industrial sponsors or emerging research issues that represent the major specialty areas including ceramics, metals, polymers, or electronic materials.

MAT 430 Physical Metallurgy Laboratory. *Coreq: MAT 431. 1(0 3) F.* Laboratory experiments dealing with the mechanical properties and structure of ferrous and non ferrous metals.

MAT 431 Physical Metallurgy I. *Preq: MAT 321, 450; Coreq: MAT 430. 4(4 0) F.* Application and design of selected ferrous and nonferrous alloys in a theoretical and a practical context. Factors which improve resistance to fatigue failure, creep failure, corrosion, oxidation and brittle fracture. Iron-, aluminum-, copper-, nickel- and titanium-base alloys.

MAT 432 Physical Metallurgy II. *Preq: MAT 431. 3(3 0) S.* Application and design of alloys for a particular use in a theoretical and a practical context. Alloy systems considered: cast irons, stainless steels and tool steels, cobalt- and magnesium-base alloys, refractory metals, heavy metals and precious metals. Surface treatments, electrometallurgy, oxidation and corrosion.

MAT 434 Ceramic Engineering Laboratory. *Coreq: MAT 435. 1(0-3) S.* Processing of ceramic materials. Two compositions will be processed from raw materials to finished products. Evaluations made after each processing step. Effects of composition, equipment design, and processing conditions on properties in the fired ware.

MAT 435 Physical Ceramics I. *Coreqs: MAT 321, MAT 434. 3(3-0) S.* Physical and chemical nature of classical and newly discovered ceramic materials. Thermodynamics,

crystal structure, structural imperfections, phase transformations and microstructure and their collective effects on thermal, elastic and strength properties.

MAT 440 Processing of Metallic Materials. *Preqs: MAT 321, MAT 450; Coreq: MAT 431, 3(3-0) F.* Fundamental concepts of solidification and their application to foundry and welding practices; metal forming concepts applied to forging, rolling, extrusion, drawing, and sheet forming operations; machining mechanisms and methods; powder metallurgy; advanced processing methods including rapid solidification and mechanical alloying.

MAT 450 Mechanical Properties of Materials. *Preqs: MAT 325 and 330; CE 313, 3(3-0) S.* Elastic, plastic, and fracture or failure phenomena in solids treated in terms of fundamental deformation mechanisms and the role of microstructure. Tensile, creep, fatigue and viscoelastic modes of deformation and design considerations.

MAT 460 Microelectronic Materials. *Preqs: MAT 332, 3(3-0) S.* Processes and problems relevant to microelectronic materials technology. Boule growth, wafer preparation, epitaxial growth, doping techniques and device applications of elemental, binary and ternary compound semiconductors. Electrical, optical and chemical characterization of semiconductors and materials considerations relevant to device fabrication, bonding and packaging. ROZGONYI

MAT 490 Special Topics in Materials Engineering. *Preq: Permission of Instructor, 1-4.* Offered as needed for the development of new courses in materials engineering, including areas such as metals, ceramics, polymers, or microelectronic materials.

MAT 491 Materials Engineering Seminar. *Preq: Sr. standing, 1(1-0) F,S.* Survey of selected topics and professional aspects of materials science and engineering. Written and oral reports by students and presentations by faculty and guest lecturers.

MAT 495 Materials Engineering Projects. *Preq: Jr. or sr. standing. Departmental approval required, 1-6 F,S.* Application of engineering principles to a specific materials engineering project by a student or small group of students under supervision of a faculty member. A written report required.

Selected 500-Level Courses Open To Advanced Undergraduates

MAT 500 Modern Concepts in Materials Science. *Preq: Grad. Standing or CI, 3(3-0) F.*

MAT 502 Defects in Solids. *Preq: CI, 3(3-0) S.*

MAT 504 Electrical, Optical and Magnetic Properties of Materials. *Preqs: MAT 331, MAT 500 and 510 or CI, 3(3-0) S.*

MAT 508 Thermodynamics of Materials. *Preq: MAT 301 or equivalent, 3(3-0) F.*

MAT 510 Elements of Crystallography and Diffraction. *Preq: MAT 332; Coreq: MAT 500 or CI, 3(3-0) F.*

MAT 511 Stereology and Image Analysis. *Preq: Grad. Standing or CI, 3(3-0) S. Alt. yrs.*

MAT 512 Scanning Electron Microscopy. *Preq: Grad. Standing or CI, 3(3-0) F.*

MAT (MAE) 531 Materials Processing by Deformation. *Preq: Six hours of solid mechanics and or materials, 3(3-0) F.*

MAT (MAE) 532 Fundamentals of Metal Machining Theory. *Preq: Six hours of solid mechanics and or materials, 3(3-0) F.*

MAT 556 Composite Materials. *Preq: MAT 450, 3(3-0) F.*

MAT 560 Materials Science and Processing of Semiconductor Devices. *Preq: MAT 460, 3(3-0) S.*

MAT 595 Advanced Materials Experiments. *Preq: Sr. or grad. standing, 1-3.*

MICROBIOLOGY

MB 200 Microbiology and World Affairs. *3(3 0) S.* An integrated and comprehensive study of the microbial world and its influence on global events and human affairs.

MB 401 General Microbiology. *Preqs: BS 100, CH 223 or 220, 4 (3 3) F,S.* Rigorous introduction to basic principles of microbiology. Designed for students in biological and agricultural sciences and for all students planning to take further courses in microbiology.

MB (FS) 405 Food Microbiology. *Preq: MB 401, 3(2-3) F.* Microorganisms of importance in foods and their metabolic activities. Source of microbial contamination during food production, processing and storage. Microbial spoilage; foods as vectors of human pathogens. Physical and chemical destruction of microorganisms in foods and the kinetics involved. Conversions of raw foods by microorganisms into food products. Microbiological standards for regulatory and trade purposes.

MB 411 Medical Microbiology. *Preq: MB 401, 4(3-3) S.* Comprehensive study of microbial pathogenesis and host resistance. Diagnosis, prevention, and therapy of common diseases of microbial origin. Laboratory practice in clinical bacteriology, immunology and virology. LUGINBUHL

MB 414 Microbial Metabolic Regulation. *Preq: MB 401, BCH 451, 3(3 0) F.* An integrative perspective on bacterial physiology and metabolism through an analysis of metabolic regulatory functions.

MB 490 Seminar in Microbiology. *Preqs: MB 401 and senior standing, 1(1-0) F.* Students research, prepare and orally present current topics in all areas of microbiology. Emphasis on new developments and technologies, and in preparing for careers and further study.

MB 492 External Learning Experience. *Preq: Sophomore standing, 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

MB 493 Special Problems in Microbiology. *Preq: Sophomore standing, 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

MB 495 Special Topics in Microbiology. *1 3 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

MB 503 Microbial Diversity. *Preq: MB 401 (2 0) Alt. S.*

MB 518 Introductory Virology. *Preq: MB 401 or GN 411 or BCH 456 (3 0) F.*

MB (SSC) 532 Soil Microbiology. *Preqs: MB 401; CH 220 or CI. 4(3 3) S.*

MB 551 Immunology. *Preqs: MB 401, GN 411 and BCH 451 (3-0) S.*

MB (ZO) 555 Protozoology. *Preq: CI. 4(2 6) S. Alt. odd yrs.*

MB 558 Prokaryotic Molecular Genetics. *Preqs: MB 401, BCH 451, GN 411 (3-0) S.*

MB (BO) 574 Phycology. *Preq: BS 100 or BO 200, 3(1 4) S.*

MB (BO, PP) 575 The Fungi. *Preq: BO 200 or equivalent, 3(3 0) F.*

MB (BO, PP) 576 The Fungi Lab. *Coreq: BO 575, 1(0-3) F.*

MULTIDISCIPLINARY STUDIES

MDS 101 Introduction to University Education I. *1(1 1) F,S.* Developmental and academic topics to assist students in making rational decisions about majors.

MDS 102 Introduction to University Education II. *Preq: MDS 101. 1(1 1) S.* Scope and objectives of NCSU programs of study. Exploration of schools and departments through faculty lectures and individual projects. Career opportunities and decision-making strategies.

MDS 103 Images of the Future. *Preq: University Undesignated Freshmen status. 3(3-0) F.* Basic principles of futures studies; history, problems, limitations, and methods of forecasting; questions of change, quality of life, complexity, technology, and values.

MDS 104 The Experience and Interpretations of Freedom. *Preq: University Undesignated Freshmen status. 3(3 0) F,S.* Interdisciplinary introduction to freedom as a basic theme in history, culture, and personal life. Focus on interplay between the experience of freedom and its various interpretations.

MDS 105 A Systems Approach to the Universe. *3(3-0) S.* Systems approaches to problems in physical, social, and behavioral sciences and technology. Concepts of general systems (interactions between systems functioning). Emphasis in interdisciplinary problem solving methods and critical questioning.

MDS 201 Environmental Ethics. *3(3 0) F,S.* Interdisciplinary consideration of ways in which field of study coupled with personal cultural values contribute towards either solving or compounding environmental problems; provides framework for process of making ethical decisions.
MALLOY HANLEY

MDS 214 Technology and Values. *3(3 0) F.* Introduction to the relations of technology and society. Emphasis placed upon the nature of technology, contrasting attitudes towards technology, technology's relation to the individual and to values, and to the future relations of technology and society.
HOFFMAN

MDS 220 Coastal and Ocean Frontiers. *3(3-0) F.* Interdisciplinary approach to current issues, scientific concepts, management strategies and future trends concerning the coasts and the oceans. Required weekend field trip.
SPENCE

MDS 240 Introduction to African-American Studies. *3(3-0) F,S.* An interdisciplinary study of Sub-Saharan Africa, its arts, culture, and people, and of the African American experience.
HAMMOND

MDS 295 Special Topics in Multidisciplinary Studies. *1 6 F,S.* Detailed investigation of an interdisciplinary topic. Topic and mode of study to be determined by faculty member and or teaching team.

MDS 301 Science and Civilization. *Preq: Soph. standing. 3(3-0) F,S.* An inquiry into the scientific achievement and cultural impact of three different, but interrelated, models (or paradigms) of understanding the world and man's place in it; the Ancient-Medieval model of Aristotle, Ptolemy and Aquinas; the 17th century model of Newtonian physics; and the emerging, but fragmentary, 20th century model based upon the "new physics" of Einstein, Planck and Heisenberg.
HOFFMAN, MALLOY HANLEY, STALNAKER

MDS 302 Contemporary Science and Human Values. *Preq: Soph. standing. 3(3 0) F,S.* An interdisciplinary evaluation of recent and potential influences of current scientific-technological developments on society. Emerging social, ethical, and intellectual issues include: the adequacy of contemporary scientific frameworks; the relations among science, technology, and society; the social consequences of scientific applications; and human prospects and possibilities.
GRIMES, HOFFMAN, KORTE, HAMLETT

MDS 303 Humans and the Environment. *3(3-0) F, S.* Interactions among human populations in the biophysical system and the environment. Emphasis on current issues, ecological principles and their relationships to basic biophysical processes; considers food, population dynamics, public land and common resources, renewable natural resources, pollution, water resources, energy and non-renewable resources.
ADAMS

MDS 320 Ethics in Engineering. *Preq: Junior standing. 3(3-0) S.* Engineering in American culture and the emerging ethical issues confronting the profession: corporate responsibility, personal rights, whistle blowing, conflicts of interest, advertising, corporate disclosure, professional autonomy, risk assessment, and the place and purpose of Engineering codes of ethics. STALNAKER

MDS 323 World Population and Food Prospects. *3(3-0) S.* Examination of the dynamics of population size and food needs, production, distribution and utilization. Consequences of inadequate nutrition and food choices, efforts to increase the compatibility of effective food production systems and alternate crops and cropping systems examined. PATTERSON

MDS 324 Alternative Futures. *3(3 0) F.S.* Possible alternative futures and the cutting edge of the present in perspective. Special emphasis on the nature and likelihood of various alternatives, the methodology and limitations of forecasting, selected futurist issues, and the interactions between present and possible technologies and human values. HOFFMAN

MDS 325 Bio-Medical Ethics: An Interdisciplinary Inquiry. *3(3 0) F.* An interdisciplinary examination and appraisal of emerging ethical and social issues resulting from recent advances in the biological and medical sciences. Abortion, euthanasia, consent, truth telling, confidentiality, paternalism, genetic engineering and behavior control. Focus on factual details, value questions, the interplay of fact and value, assessment of impacts, and questions of policy formulation. STALNAKER

MDS 326 Technology Assessment. *3(3-0) S.* Impacts of technologies as they are applied in society. Description and forecasting of effects, interactions, and potential irreversibilities. HOFFMAN

MDS 327 Modern Art-Modern Literature: 1880-1980. *3(3 0) S.* Interrelationship of art and literature, 1880-1980, from classic Modern movements to contemporary Post modern movements; major figures, such as Picasso, Ernst, Magritte, De Kooning, Warhol, and Kiefer in art and O'Neill, Woolf, Faulkner, Beckett, Sartre, and Vonnegut in literature.

MDS (HI) 340 Perspectives in Agricultural History. *3(3 0) S.* Historical topics related to the heritage of agriculture, the biological sciences, and the relationship among agriculture, technology, science and society. KIMLER

MDS 351 Arts, Ideas and Values. *3(3-0) F.* An examination of the way works of art embody a particular understanding of what is real and what is worthwhile and shape their viewers' ideas and values. Case studies approach. GREENE

MDS 352 Dress, Style, and Change. *Preq: Junior standing. 3(3-0) S.* Interdisciplinary course focusing on historical and cultural principles of style as related to dress and fashion. Examination of fashion and stylistic trends in cycles of dress. McILWEE

MDS 401 The Contemporary City: Problems and Prospects. *Preq: Sophomore standing.* Interdisciplinary examination of the social and physical characteristics of the contemporary city and problems which cities face. Topics include urban design, social relationships, education, transportation, crime and violence, and urban psychology. Alternative solutions to various urban problems examined. KORTE

MDS 402 Peace and War in the Nuclear Age. *3(3-0) F.* An interdisciplinary examination of contemporary wars and international conflicts, arms races, nuclear strategy and defense policy, arms control, and theories of peace. HAMLETT

MDS 403 Seminar in Technology and Society. *Preq: Sophomore standing. 3(3-0) S. Alt. yr.* Exploration of the phenomenon of technology in society. The nature of technology, policy issues, the question of values, technological forecasting, and the implications of future technologies. HOFFMAN

MDS 405 Technology and American Culture. *3(3-0) F.S.* An interdisciplinary study of the role of technology in American culture which examines the ideological, political, social, economic, and institutional contexts of technological change from the 1760's to the present, and explores the cultural impacts of new technological systems.

MDS 406 Conservation of Biological Diversity. *Preq: Junior standing and one year of Biological Science. 3(3 0) S.* Population biology concepts fundamental to understanding the properties of the objects of conservation. Genetic diversity in agriculture, forestry, and animal breeding; the ethical and international policy issues in preservation and management.

MDS 410 Toxic Substances and Society. *Preq: Junior standing. 3(3 0) S.* An interdisciplinary evaluation of the past, present and future human health effects of toxic substances at work, at home, and through our food. The political, economic, and ethical dimensions of toxic substances and ways of minimizing their adverse effects. GRIMES

MDS 412 Entering the 21st Century: Agricultural, Technological & Environmental Perspectives. *3(3-0) F.* Systems approach to predictions about the world in the year 2000 from the perspectives of agricultural and environmental studies. Attention to food production, fisheries, forests, water, energy, material resources for fuel, climate, and population. Guest lectures and class projects. ELKAN

MDS (HI) 445 History of American Technology. *Preq: 3 hours of history. 3(3 0) F.S.* Technology in American history: the ideological, social, economic, and institutional contexts of technological change from the 1760's to the present. Impacts of new technological systems.

MDS 490 Issues in Science, Technology, and Society. *Preq: Junior standing. 3(3 0) F.S.* Examination of a significant issue, method, or historical episode in the area of science, technology, and society. Toward end of term, the seminar will meet with a University Symposium on the same subject as the seminar.

MDS 494 Topics in Arts Studies. *Preq: Junior standing and 15 hours in either dance, design, film studies, music, theatre, or visual arts. 3(3 0) F.S.* Multiarts course focusing on selected works of art in various media, related by theme, place or date. Capstone course for students with an extensive background in one of the arts. Topics may vary.

MDS 495 Special Topics in Multidisciplinary Studies. *1 6 F, S.* Examination of selected topics of an interdisciplinary nature.

MDS 496 Topics in Film and Interdisciplinary Studies. *3(4-0) F.S.* Detailed examination of film within interdisciplinary contexts. Specific topics will vary from semester to semester.

MDS 498 Independent Study in Multidisciplinary Studies. *Preq: Permission of instructor. 1 3 F.S.* Independent investigation and discussion of a selected topic of an interdisciplinary nature.

Selected 500-Level Courses Open To Advanced Undergraduates

MDS (FOR) 584 The Practice of Environmental Impact Assessment. *4(0 8) F.*

MDS 595 Special Topics in Multidisciplinary Studies. *Preq: Grad. standing or CI. 1 3 F.S.*

MARINE, EARTH AND ATMOSPHERIC SCIENCES

INTRODUCTORY COURSES IN MARINE, EARTH AND ATMOSPHERIC SCIENCES

MEA 101 Geology I: Physical. *Recommended that MEA 110 be taken concurrently. 3(3-0) F.S. Sum.* Systematic consideration of processes operating on and below the earth's surface and the resulting features of landscape, earth structures, and earth materials. Occurrences and utilization of the earth's physical resources.

MEA 102 Geology II: Historical. *Preq: MEA 101. Recommended that MEA 111 be taken concurrently.* 3(3-0) S. The second semester of the basic introductory sequence in geology. Utilization of the principles of geology to reconstruct and understand the earth's history. Geologic events that cause modification of the earth's crust, emphasizing North America. History of life and the environmental significance of changes in animal and plant life through geologic time.
LEITHOLD

MEA 110 Geology I Laboratory. *Coreq: MEA 101. 1(0-3) F.S. Sum.* Scientific methodology applied to the study of common rock forming minerals, common rocks, topographic maps, geologic structures and geological maps. Field trips.

MEA 111 Geology II Laboratory. *Coreq: MEA 102. 1(0-2) S.* Reconstruction and interpretation of events in the history of the earth. Interpretation of sedimentary rocks, construction and interpretation of geological maps, identification of fossil organisms and utilization of fossils in the reconstruction of earth history.

MEA 130 Introduction to Weather and Climate. *For non majors only. 3(3-0) F.S.* Explores the structure, physical causes, and climatology of weather systems including the jet streams, mid-latitude cyclones, hurricanes, thunderstorms, and tornadoes. Clouds and precipitation, air pollution, climate modification, optical effects (rainbows, halos) and weather instruments. Weather systems and forecasting techniques are illustrated through daily weather map discussions.

MEA 135 Introduction to Weather and Climate Laboratory. *Coreq: MEA 130. 1(0-2) F.S.* Supplements material in MEA 130. Meteorological instruments; weather observations; analysis, graphical display and interpretation of data; structure of weather systems; principles of weather forecasting.

MEA 140 Natural Hazards and Global Change. 3(3-0). The science of natural hazards and global change: the impact on human civilization of events in the lithosphere, atmosphere, biosphere, and hydrosphere (e.g., earthquakes, hurricanes, red tides, and floods), and the impact of humans on the global environment (e.g., global warming).

MEA 200 Introduction to Oceanography. *Preq: High school physics, chemistry, algebra, trigonometry and biology or equivalent. 3(3-0) F.S.* The ocean as a part of our environment including interactions between atmosphere and ocean, ocean circulation, physical and chemical properties of sea water, marine geology and marine biology.

KNOWLES, WOLCOTT

MEA 208 Introduction to Environmental Geography. 3(3 0) S. *Alt. yrs.* Our physical environment; the interrelation between man and his physical environment. Topics include atmospheric, and oceanic structures and landforms. Interaction of land, sea, air and interaction of man and his environment. Use of geographic tools.

KIMBERLEY, RIORDAN

MEA (ZO) 220 Marine Biology. *Preq: MEA 200 or BS 100. 3(3-0) S.* An introduction to marine plants and animals, their adaptations to life in the sea and ecological interactions in selected marine environments (e.g. coral reefs, deep sea, salt marshes). Interactions of man with the sea: food from the seas, biology of diving. Weekend field trip optional.

WOLCOTT

ADVANCED COURSES: EARTH SCIENCE (GEOLOGY/GEOPHYSICS)

MEA 300 Environmental Geology. *Preq: MEA 101 or MEA 140, or SSC 200. 3(3-0).* Geologic aspects of the environment; man's effect upon and interaction with the various geologic processes; geologic considerations in land-use planning, waste disposal, and effective use of the earth's natural resources; geologic risks and hazards. Required field trip.

MEA 330 Crystallography and Mineralogy. *Preq: MEA 101; Coreqs: CH 101 121, MEA 110. 4(2-4) F.* Fundamentals of descriptive and quantitative crystallography, crystal chemistry, and crystal physics. Introduction to minerals as naturally occurring solid state materials. Characterization and identification of minerals on the basis of crystallographic features, physical and chemical properties, geologic occurrence, phase relations, and uses. Systematic review of rock-forming minerals.
SPEER

MEA 331 Optical Mineralogy. *Coreq: MEA 330, 2(1-2) F.* Identification of the non-opaque rock-forming minerals with the polarizing microscope. Determination of the optical properties of isotropic, uniaxial, and biaxial minerals, including refractive indices, birefringence, optic sign, and orientation. Emphasis on petrographic thin sections.

STODDARD

MEA 410 Introduction to Geologic Materials *Preq: MEA 101; CH 101 121, 4(3-3) S.* Basic principles of mineralogy and petrology. Common rock-forming and ore-forming minerals. Introduction to igneous, metamorphic, and sedimentary environments and rocks. Description and classification of common rocks and minerals. Required field trips.

STODDARD, CAVAROC

MEA 415 Geology of Economic Mineral Deposits. *Preq: MEA 330; MEA 440 and 450 recommended, 3(2-3) S. Alt. Yrs.* The nature, geologic setting and geographic distribution of economic mineral deposits. Topics include both metallic and industrial minerals and the various geologic processes that work to produce them. Laboratory work with economic mineral suites from famous mining districts of the world. Two to three weekend field trips required.

MEA 439 Elements of Igneous and Metamorphic Petrology. *Preq: MEA 330. Credit for both MEA 439 and MEA 440 is not allowed. 3(3-0) S.* Rocks formed by the crystallization of magmas (igneous) at the surface and subsurface and by the solid-state recrystallization of existing rocks (metamorphic). Origins of these rocks and related geologic processes interpreted within the framework of plate tectonics, whole-rock and mineral chemistry, and phase equilibria. Identical to MEA 440, except that there is no laboratory.

FODOR

MEA 440 Igneous and Metamorphic Petrology. *Preq: MEA 331, 4(3-3) S.* Rocks formed by the crystallization of magmas (igneous) at the surface and subsurface and by the solid-state recrystallization of existing rocks (metamorphic). Origins of these rocks and related geologic processes interpreted within the framework of plate tectonics, whole-rock and mineral chemistry, and phase equilibria. Identification, classification, microscopy, mineralogy.

FODOR

MEA 450 Introductory Sedimentary Petrology/Stratigraphy. *Coreq: MEA 331, 4(3-3) F.* Identification, classification, geologic occurrence, and origin of minerals and rocks formed by physical, chemical and biological processes at and near the earth's surface. Principles of divisions of stratified terrains into natural units, correlation of strata, interpretation of depositional environments and facies. Required field trips.

CAVAROC

MEA 451 Structural Geology. *Preqs: MEA 101; MEA 110, 4(3-3) S.* Basic principles of rock mechanics; stress-strain analysis of deformed rocks. Nature and mechanisms of formation of joints, cleavage, faults, folds and other structural features of the earth's crust. Introduction to geotectonics. Required overnight field trips.

HIBBARD

MEA (CE) 456 Air Quality. *Preq: MEA 422; CE 280, 382 and 384, 3(3-0) F.* Introduction to air quality engineering and meteorology. Air quality management, air quality meteorology, atmospheric emissions and dispersion modeling, and control technology principles.

MEA 461 Engineering Geology. *Preq: MEA 101, 3(3-0) S. Alt yrs.* Geologic and geotechnical engineering principles and techniques for engineering projects. Identification of important material properties and methods of determining these properties. Case studies presented.

HIBBARD, LAMBE

MEA 465 Geologic Field Camp I. *Preqs: MEA 440, 450, 451. First part of six weeks out of state summer field camp. Both MEA 465 and MEA 466 must be taken in the same summer. 3. Sum.* Geological field instruments and techniques. Geological field mapping of various geologic structures and terrains within areas of little deformed sedimentary strata. Additional fees required.

MEA 466 Geologic Field Camp II. *Preq: MEA 465. Second part of six weeks out-of state summer field camp. Both MEA 465 and MEA 466 must be taken in the same summer. 3 cr. Sum.* Advanced geologic field techniques. Geologic field mapping in areas of complexly deformed rocks. Areas of volcanic, plutonic, or metamorphic rocks commonly mapped. Regional field trips between field stations. Additional fees required.

MEA 468 Invertebrate Paleontology and Biostratigraphy. *Preqs: MEA 102 and MEA 111, or ZO 302. 4(3-3) F.* Study of fossil invertebrates and their applications to problems and concepts of paleoecology, correlation of strata, evolution and broader concepts of earth history. Required field trips. SHOWERS

MEA 470 Introduction to Geophysics. *Preqs: PY 208 or 212; 3(3 0) F.* Structure of the earth, a dynamic and evolving entity, as inferred from seismology, gravity, magnetism and heat flow. Geodynamic processes responsible for continental drift; plate tectonic theory; regional geophysics of selected areas. BEVIS

MEA 471 Exploration and Engineering Geophysics. *Preq: MEA 470 or PY 208. Credit may not be received for both MEA 471 and MEA 570. 3(3-0).* Geophysical methods as applied to exploring the earth's mineral and energy resources, and investigating subsurface geological structure and its physical properties. Principles, measurements, analyses, and interpretations of gravity, magnetic, electric, electromagnetic, seismic methods. EVANS

MEA 475 Geophysical Field Methods. *Preq: MEA 471. Credit is not allowed for both MEA 475 and MEA 575. 2 cr. Sum. field camp.* Practical geophysical field measurements using instruments for gravity, magnetic, electric, electromagnetic and radioactivity methods. Data interpretation in terms of subsurface geological structures and their physical properties, locations, sizes and shapes. Students must register for the course in the second summer session. Location: North Carolina. Estimated expense: \$150.00. EVANS BEVIS

MEA 476 Seismic Exploration for Oil. *Preq: PY 208, knowledge of FORTRAN. Credit is not allowed for both MEA 476 and MEA 576. 3(3-0).* A comprehensive introduction to the reflection seismic method as applied to exploring oil and gas resources. Seismic instrumentation, field data acquisition, common-depth point method, deconvolution, digital filtering, migration, and seismic stratigraphy of hydro-carbon depositional environments, along with computer oriented exercises.

MEA 481 Principles of Geomorphology. *Preqs: MEA 101 and MEA 110. 3(2-2).* Landforms and the processes responsible for their origin. Emphasis on the geologic principles involved in interpreting the origin and evolution of various landforms, and discussion of North American geomorphic process.

MEA 491 Seminar on Selected Geologic Topics. *Preq: Senior standing in GYS, GYA, or GPY. 2(2-0) S.* Study and discussion of selected topics from the geological literature. Preparation and presentation of geological reports.

MEA 493A Special Topics in Earth Sciences. *Preq: Consent of department. 1-6 As necessary.* Directed individual study or experimental course offering.

Selected 500-Level Courses Open To Advanced Undergraduates

MEA 500 Regional Geology of North America. *Preqs: MEA 101. Sr. standing. 1-6.*

MEA 510 Geological Oceanography. *Preq: MEA 450 or equivalent. 3(3-0) F.*

MEA 515 Topics in Appalachian Geology. *Preqs: MEA 440, 450 and 451. 3(3 0) Alt. F.*

MEA 522 Petroleum Geology. *Preq: MEA 450. 3(3-0).*

MEA 523 Introduction to Subsurface Well Evaluation. *Preqs: CH 103, PY 212, MEA 101. 3(2-3).*

MEA 545 Advanced Igneous Petrology. *Preq: MEA 440. 3(2 2). Alt. F.*

MEA 546 Advanced Metamorphic Petrology. *Preq: MEA 440. 3(2 2). Alt. S.*

MEA 551 Advanced Structural Geology. *Preq: MEA 451. 3(2 3). Alt. F.*

MEA 562 Applied Sedimentary Analysis. *Preqs: MEA 450, ST 361. 3(2 2). Alt. S.*

MEA 564 Depositional Environments and Lithostratigraphy. *Preq: MEA 450 or grad. standing. 3(2-3). Alt. S.*

- MEA 565 **Hydrogeology.** *Preq: MEA 450, 3(3 0) Alt. S.*
- MEA 567 **Geochemistry.** *Preq: CH 331 or 433, 3(3 0).*
- MEA 570 **Exploration and Engineering Geophysics.** *Preq: MEA 470 or PY 208, 3(3-0).*
- MEA 577 **Sedimentary Geochemistry.** *Preqs: CH 331 or CH 431 or MEA 567 or equivalent background, 3(3-0).*
- MEA 583 **Photogeology and Remote Sensing.** *Preqs: MEA 101 or 120; MEA 481 or equivalent, 3(2 3).*
- MEA 588 **Regional Tectonics.** *Preqs: MEA 440, 450, 451, 3(3-0). Alt.F.*
- MEA 593 **Special Topics.** *Preq: CI, 1-6 F.S.*

ADVANCED COURSES: MARINE SCIENCE (OCEANOGRAPHY)

MEA 493B **Special Topics in Marine Science.** *Preq: Consent of department, 1 3 F.S.* Experiment, individualized study, or research in topics of student's interest which are not covered conveniently in the scheduled courses.

Selected 500-Level Courses Open To Advanced Undergraduates

- MEA 501 **Environmental Fluid Mechanics.** *Preqs: MA 242, PY 208 3(3 1) F.*
- MEA 510 **Geological Oceanography.** *Preq: MEA 450 or equivalent, 3(3 0) F.*
- MEA (ZO) 520 **Principles of Biological Oceanography.** *Preqs: BS 100 and either BO (ZO) 360 or grad. standing, 3(3 0) S.*
- MEA (CE) 541 **Gravity Wave Theory I.** *Preq: MAE 308 or PY 411, 3(3-0) S.*
- MEA 560 **Principles of Physical Oceanography.** *Preqs: MA 231 and PY 212 or equivalent, 3(3 0) S.*
- MEA 561 **Introduction to Physical Oceanography.** *Preqs: MA 341, PY 208 or CI, 3(3 0) F.*
- MEA 569 **The Physical Dynamics of Estuaries.** *Preqs: MA 242 or 231; PY 208 or 212, 3(3 0) Alt. S.*
- MEA 571 **Principles of Chemical Oceanography.** *Preq: CH 107 or equivalent, 3(3 0) F.*
- MEA 593 **Special Topics.** *Preq: CI, 1 3 F.S.*

ADVANCED COURSES: ATMOSPHERIC SCIENCE (METEOROLOGY)

MEA 311 **Physical Climatology.** *Preqs: PY 205, 211 or 221; Coreq: MA 241, or 231, 3(3 0). F.* Physical basis for weather and climates on earth, approached from the principles of physical climatology. Solar energy incident to, and modified by, the atmosphere; terrestrial radiation; transports of heat and water substance; heat balances and imbalances. Consequences to distributions of temperature, mass, motions, and weather. DAVIS

MEA 312 **Physical Meteorology.** *Preqs: PY 205 or 211 or 221, Coreq: MA 241, PY 208 or PY 212, 3(3 0) S.* Principles and concepts for understanding the atmosphere and various meteorological phenomena taking place in it such as dew, frost, fog, clouds, precipitation and vertical motions, thunderstorms, tornadoes, and hurricanes. These phenomena are explained using the basic principles of thermodynamics, statics, and buoyancy. SAXENA

MEA 313 **Meteorology Laboratory I.** *Preq: MA 141 or 131, Coreq: PY 205 or 211 or 221, 1(0-3) F.* Supplements material in MEA 311: Surface data and analysis techniques, instrumentation, global energy budgets and transports, climatological distribution of weather variables, the structure and evolution of the mid latitude cyclone. RIORDAN

MEA 314 Meteorological Laboratory II. *Preq: MA 141 or 131; Coreq: PY 205 or 211 or 221. 1(0 3) S.* Supplements material in MEA 312: Meteorological fields, variation of temperature with height, measurement and calculation of water-vapor, cloud processes, thermodynamics applied to stability and thunderstorms. WATSON

MEA 405 Climatological Data Analysis. *Preq: MEA 311 and ST 361. 3(3-0) S.* Probability and statistics applied to climatology and meteorology. Discrete and continuous probability distributions of meteorological variables examined. Regression analysis applied to weather forecasting. Forecast verification. Smoothing and filtering processes. Introduction to time series analysis. Elementary decision theory. DAVIS

MEA 412 Atmospheric Physics. *Preqs: MA 242, PY 208 or equivalent. 3(3-0) S.* Physical and analytical descriptions of atmospheric aerosols, clouds fogs, and precipitation processes; size distribution and sources of atmospheric aerosols; impact of aerosols on visibility and climate; microstructure of warm and cold clouds and their interaction with solar and terrestrial radiation; collision-coalescence and ice phase mechanisms of precipitation formation; atmospheric electricity; planned and inadvertent weather modification; weather radar; atmospheric optics. SAXENA

MEA 421 Atmospheric Dynamics I. *Preqs: MA 242, PY 208, MEA 311, 312, 313, 314. 4(3-2) F.* Atmospheric thermodynamics: composition of air; applications of elementary kinetic theory and principles of energy and mass conservation; phase change of water. Principles of atmospheric statics: altimetry, static stability. Meteorological applications of fluid kinematics: applications of vector analysis; relationships among streamlines, trajectories, and streak lines; Lagrangian and Eulerian perspectives; linear properties of atmospheric motion fields. LIN, RIORDAN

MEA 422 Atmospheric Dynamics II. *Preqs: MEA 421. 4(3-2) S.* Atmospheric dynamics: review of Newton's laws of motion; application to fluids; forces in the atmosphere, the vector equation of motion on a rotating earth; component equations in spherical coordinates; scale analysis and simplifications; vorticity; pressure coordinates; geostrophic, gradient, cyclostrophic, and inertial winds; vertical shear of the wind (thermal wind); the planetary boundary layer; introduction to dynamics of waves. LIN, RIORDAN

MEA 443 Weather Analysis and Forecasting I. *Preqs: MEA 421. 3(1 6) F.* Time and space distributions of cloud and weather systems. Sounding analysis with application to moisture distribution and aircraft icing; sounding modification processing. Vertical structure of fronts, tropopause, and jet streams; clear air turbulence. Three dimensional structure and evolution of pressure systems. Analysis of the wind field; calculation of kinematic properties. BUSINGER, WATSON

MEA 444 Weather Analysis and Forecasting II. *Preq: MEA 443. 3(1 6) S.* Introduction to statistical forecasting methods; applications to local forecast studies. Three dimensional structure of weather systems as revealed by isentropic analysis; applications to forecasting clouds and precipitation. Applications of quasi geostrophic theory to understanding and forecasting cyclone motion and development; application to forecasting clouds and precipitation, severe weather analysis and forecasting. Numerical weather prediction. BUSINGER, WATSON

MEA 455 Micrometeorology. *Preq: MEA 422 or MAE 308. 3(3 0) F.* Energy budget near the earth's surface; soil temperatures and heat transfer; air temperature, humidity, and wind distribution in the planetary boundary layer; fundamentals of viscous flows and turbulence; semiempirical theories of turbulence; exchanges of momentum, heat and moisture in the atmospheric surface layer; air modification due to changes in surface properties; agricultural and forest micrometeorology. ARYA, RAMAN

MEA (CE) 456 Air Quality. *Preqs: MEA 411; or CE 384; or 280 plus CE 382. 3(3-0).* Introduction to air quality engineering and meteorology. Air quality management, air quality meteorology, atmospheric emissions and dispersion modeling, and control technology principles. ARYA

MEA 493C Special Topics in Atmospheric Science. *Prq: Consent of department. 1-3 F.S.* Experiment, individualized study, or research in topics of student's interest which are not covered conveniently in the scheduled courses.

Selected 500-Level Courses Open To Advanced Undergraduates

MEA 512 Satellite Meteorology. *Prq: MA 242; Coreq: MEA 443. 3(3 0) Alt. S.*

MEA 516 Atmospheric Chemistry. *Preqs: CH 105, MA 241.*

MEA 524 Dynamic Meteorology. *Prq: MEA 422 or equivalent. 3(3 0) F.*

MEA 526 Air-Sea Interaction. *Prq: MEA 422 or MEA 560 or CI. 3(3 0) Alt. S.*

MEA 527 Planetary Boundary Layer. *Prq: MEA 455 or MEA 526 or CI. 3(3-0) Alt. F.S.*

MEA 528 Coastal Meteorology. *Prq: MEA 455. 3(3 0).*

MEA 555 Meteorology of the Biosphere. *Preqs: PY 205 or 211; CH 103 or 107; MA 141 or 131. 3(3 0) F.*

MEA 556 Air Pollution Meteorology. *Preqs: MAE 308 or 455 or 501 or equivalent. 3(3-0) S.*

MEA 557 Advanced Cloud and Precipitation Physics. *Prq: MEA 421 or MEA 412. 3(3 0) Alt F.*

MEA 558 Atmospheric Aerosols. *Preqs: CH 103 or 107 and PY 205 or 211; Coreq: MEA 412. 3(3 0) Alt. S.*

MEA 593 Special Topics. *Prq: CI. 1 6 F.S,Sum.*

MILITARY SCIENCE (ARMY ROTC)

MS 101 Introduction to ROTC and the Army. *Enrollment limited to freshman and sophomore students only. 1(1 1) F.S.* The mission and organization of the U.S. Army and an introduction to ROTC. Advantages, opportunities and benefits of becoming an officer in the Army. Role of the U.S. Army in current events.

MS 106 Map Reading. *Enrollment limited to freshman and sophomore students only. 1(1 1) S.* Basic map reading techniques; determination of present location through the use of intersection and resection procedures; information for outdoor activities, ranging from competitive orienteering to occasional backpacking.

MS 201 Basic Military Leadership. *Preqs: MS 101 and 106. 2(2-1) F.* Basic instruction and practical work in the fields of leadership and management. Emphasis is on the elemental supervisor, subordinate relationships in a formal organization. Drill and physical conditioning are incorporated into training events. Students will be issued uniforms and expected to comply with U.S. Army appearance standards.

MS 202 Basic Small Unit Tactics. *Preqs: MS 101 and MS 106. 2(2 1) S.* Principles of small unit (squad level) tactics and their application. Emphasis on basic individual skills and knowledge required to lead squad size organizations. Student leadership laboratory sessions apply tactical principles.

MS 301 Military Leadership and Training Management. *Prq: Advanced course cadets. 3(3-2) F.* Organizational leadership and processes in the Army; leadership activities and key management functions. Management and conduct of group training activities.

MS 302 Intermediate Small Unit Tactics. *Prq: Advanced course cadets. 3(3-2) S.* Planning, organizing and executing military operations at the squad and platoon level. Focus on the leader's actions, map reading and navigation.

MS 401 Military Law and Advanced Tactics. *Preq: MS 301, MS 302. 3(3-2) F.* The role of military justice in the Army and its impact on a soldier's actions in the military, civilian, and international communities are examined. Doctrines and philosophies which dictate the employment of platoon and company size forces, and the role of discipline in developing an effective unit are studied.

MS 402 Military Ethics and Professional Development. *Preqs: MS 301, MS 302. 3(3 2) S.* Ethics and professionalism of the officer corps. Responsibilities of small unit leaders and techniques for managing people and material. The social aspect of military life.

MUSIC

MUS 100 Instrumental Music. *Student may receive credit for only one section of MUS 100 per semester. Preq: Satisfactorily passing audition. 1(0 4) F,S.* The performance and study of the best in instrumental music. Assignments to various instrumental organizations made according to instrument played and individual interests and abilities.

MUS 101 Beginning Class Piano I. *1(0 1) F,S.* Introductory course for students with no previous piano experience. Music notation, chord formation, keyboard techniques, and ensemble playing. Reading and playing developed through folk, popular, and classical repertoire. LYNCH

MUS 110 Beginning Class Piano II. *Preqs: MUS 101 or equivalent and consent of instructor. 1(0-1) F,S.* A continuation of MUS 101. Further development through the study of more advanced repertoire. LYNCH

MUS 110 Choral Music. *Preq: Satisfactorily passing audition. 1(0-4) F,S.* Study and performance of choral music by participation in Varsity Men's Glee Club (male chorus), University Choir (mixed chorus), New Horizons Choir (mixed chorus), University Community Chorus (mixed chorus emphasizing large scale works), or Chamber Singers.

MUS 120 Rudiments of Music. *3(3-0) F.* Students with limited musical experience learn to read and notate music as well as sing and play a variety of melodies on the piano with simple chordal accompaniment. Repertoire includes music from classical, folk, and popular traditions. VOGEL

MUS 150 Vocal Techniques. *1(0 2) F,S.* Development and practice of vocal techniques suitable to solo and ensemble singing in a variety of musical styles, both historical and contemporary. WARD

MUS 200 Understanding Music. *3(3-0) F,S.* Understanding our musical heritage. Evaluation of music in terms of its content, form, stylistic period, and the elements of melody, harmony, rhythm, and tone color.

MUS 201 Introduction to Music Literature I. *3(3-0) F.* Survey of Western art music from antiquity to end of eighteenth century. Includes examination of the art of music through discourses of philosophy (aesthetics) and anthropology (ethnomusicology). Core requirement for music minor. KRAMER

MUS 202 Introduction to Music Literature II. *3(3 0) S.* Survey of Western art music from end of eighteenth century through end of twentieth century. Includes examination of contemporary popular genres and impact of media and technology on music production and consumption. Core requirement for music minor.

MUS 210 A Survey of Music in America. *3(3 0) S. Alt. yrs.* A historical survey of music in America with emphasis on the major influences which have contributed to the musical literature, investigation of forms and styles and of the roles they have played in the development of various musical traditions. HAMMOND

MUS 215 Music of the 17th and 18th Centuries. *3(3-0) Alt. yrs.* Traces and describes the evolution of European music from 1600 to 1800, with particular emphasis on characteristics of form and style as they apply to music of specific periods. Social, political, and cultural influences are highlighted, representative examples are discussed as well as major composers of each style and period. WARD

MUS 220 Music of 19th Century Europe. *3(3 0) S. Alt. yrs.* A survey of 19th century European music, including analysis of its texts, forms and composers, and its relations to other art forms of the period. STURGIS

MUS 230 Introduction to Music Drama. *3(3 0) F. Alt. yrs.* Surveys of varieties of lyric stage works from opera to musical comedy. Historical references, performance practices and musical analysis are emphasized. Designed for the student who has little or no technical knowledge of music. WARD

MUS 260 History of Jazz. *3(3 0) Alt. yrs.* History of jazz and the contributions of major artists. Emphasis of the various styles that have contributed to this American art form. Investigation of structural forms in the jazz idiom. HAMMOND

MUS 300 Chamber Music Performance. *Preq: Satisfactorily passing audition. 1(0 4) F.S.* Performance of chamber music. Emphasis on chamber literature from the sixteenth through the twentieth centuries written for a wide variety of combinations ranging from string quartets to pieces written for specific instruments and voices. VOGEL

MUS 301 Basic Music Theory I. *Preq: Ability to read music. 3(3-0) F.S.* Introductory course for students with no academic musical background. Basic elements of music taught historically through exercises in notation, ear training, written harmony, formal analysis. Application through a study of selected compositions from the musical literature and through the creation of an original composition written by each student. VOGEL

MUS 302 Basic Music Theory II. *Preqs: MUS 301, Cl. 3(3 0) F.S.* Second course in music theory. Musical analysis of representative works. Further study of chordal functions and orchestration technics through written exercises. Compositions written by students. VOGEL

MUS 305 Music Composition. *Preqs: MUS 301, MUS 302. 3(3 0) F.S.* Study and creation of musical works. Emphasis on writing original music and works imitative of conventional and contemporary musical styles. WASCHKA

MUS 320 Music of the 20th Century. *3(3-0) F.* A study of representative music from 1900 to the present. Emphasis is upon the composers, their music, and composition techniques. Traditional, atonal, serial, aleatory, and electronic music are examined. PETERS

MUS 340 The Symphony Orchestra and Its Music. *Preq: any 200-level music course. 3(3 0) F. Alt. Yrs.* Development of the symphony orchestra as a performing medium through study of significant works composed during the 18th, 19th, and 20th centuries. Emphasis on contemporary role of conductor. PETERS

MUS 495 Special Topics in Music. *1 3 F.S.* New or special subject matter not covered by existing music courses.

MUS 498 Independent Study in Music. *Preq: Departmental approval required. 1 3.* Directed independent study of selected topics for students with specialized interests in music and/or advanced musical ability. Credit and content determined by faculty member in consultation with Director of Music.

NUCLEAR ENGINEERING

NE 201 Introduction to Nuclear Engineering. *Preqs: MA 241, PY 205. 2(2-0) F.* An introduction to the concepts, systems and application of nuclear processes. Topics include radioactivity, fission, fusion, reactor concepts, biological effects of radiation, nuclear propulsion, and radioactive waste disposal. Designed to give students a broad perspective of nuclear engineering and an introduction to fundamentals and applications of nuclear energy.

NE 202 Fundamentals of Nuclear Energy. *Preq: PY 208, 4(3-2) S.* An introduction to nuclear energy. Topics include radiation detection, interaction of radiation, radioactivity, nuclear reactions, fission, fusion, radiation safety, and nuclear reactors. The laboratory stresses measurement of nuclear radiation. HANKINS

NE 301 Fundamentals of Nuclear Engineering. *Preqs: MA 301 and a C or better in NE 202, 4(3-2) F.* Topics include neutron physics, reactor theory, and reactor operation. Emphasis on basic principles underlying the design and operation of nuclear systems, facilities and applications. Laboratory sessions include the various techniques of radiation detection and measurement, reactor nuclear instrumentation, and reactor measurements. HANKINS, GILLIGAN

NE 302 Nuclear Reactor Energy Conversion. *Preqs: MAE 301, CSC 112 and a C or better in NE 301, 4(3-2) S.* An introduction to the concepts and principles of heat generation and removal in reactor systems. Topics include power cycles, reactor heat sources, analytic and numerical solutions to heat conduction problems in reactor fuel elements and single phase convection heat transfer in rod bundles. A laboratory in the basics of heat transfer is included. DOSTER

NE 401 Reactor Analysis and Design. *Preq: C or better in NE 301; Coreq: MA 401, 4(3-2) S.* Elements of nuclear reactor theory and reactor operation, including neutron slowing down and diffusion, Fermi age theory, multigroup concepts, criticality of homogenous and heterogenous reactors, and reactor dynamics. Observation and measurement of reactor behavior and correlation with theory. GILLIGAN, VERGHESE

NE 402 Reactor Engineering. *Preq: NE 302, MA 401, 4(3-2) F.* An introduction to the neutronic and thermal-hydraulic analysis of nuclear power systems. Topics include single and two phase flow, boiling heat transfer, modeling of fluid systems; reactor radiation sources, radiation interactions, radiation attenuation, and shielding. Representative design calculations are performed. DOSTER, GILLIGAN

NE 403 Nuclear Engineering Design Projects. *Preq: NE 401, NE 402, 3(2-3) S.* Student projects in design of practical nuclear engineering systems. Preliminary designs are developed by teams with advice by faculty as needed, and reports are presented in oral and written form. Current and future systems are emphasized, and use of computers is encouraged.

NE 404 Radiological, Reactor, and Environmental Safety. *Preq: NE 301 or 419, 3(3-0) F.* A basic course in health physics and the environmental aspects of nuclear power generation. Topics include: biological effects of radiation, radiation shielding dose rate evaluation, radiation monitoring, and radiological safety; reactor effluents and radioactive waste disposal; regulations governing radiation exposure and the release of radioactivity into the environment; environmental impact of nuclear power plants. MANI, DUDZIAK

NE 405 Reactor Systems. *Preq: NE 401; Coreq: NE 402, 3(3-0) F.* Nuclear power plant systems: design criteria, design parameters, and economics. Topics covered include: PWR, BWR, core design, primary loops, auxiliary and emergency systems; containment, reactor control and protection systems, accident and transient behaviors. TURINSKY

NE (MAT) 409 Nuclear Materials. *Preq: MAT 201, 2(2-0) S.* Materials used in nuclear reactors-pertinent factors in selection and utilization of the materials, and the effects of radiation on their physical, chemical and mechanical properties. MURTY

NE 412 Nuclear Fuel Cycles. *Preq: NE 401, 3(3-0) S.* Processing of nuclear fuel with description of mining, milling, conversion, enrichment, fabrication, irradiation, shipping, reprocessing, and waste disposal. Fuel cycle economics and fuel cost calculation. In-core and out-of-core nuclear fuel management, engineering concepts, and methodology. TURINSKY, VERGHESE

NE 414 Nuclear Power Plant Instrumentation. *Preqs: NE students: ECE 331, 3(3-0) F.* Instrumentation required for control and safety of a nuclear power plant. The dynamic behavior of a nuclear plant developed so that the characteristics required of the instrumentation may be stated. Methods of combining the various measured parameters, (e.g. neutron

flux, coolant flow, coolant pressure, temperature) to achieve safe operation. Protection against loss of power, lightning, and other common mode failures. MAYO

NE 419 Introduction to Nuclear Engineering. *Preqs: PY 202 or PY 208; Not open to majors in Nuclear Engineering. 3(3 0) F,S.* Electrical power generation from nuclear fission, fundamental aspects of fission chain reaction, and reactor design. Reactor types, their static and dynamic characteristics and instrumentation. Reactor operation and safety. Nuclear fusion and fusion reactor development.

NE 491 Special Topics in Nuclear Engineering. *Preq: CI. Variable credit. 1-4.* Detailed coverage of special topics.

Selected 500-Level Courses Open To Advanced Undergraduates

NE 508 Radiation Safety. *Preq: NE 401 or NE 520. 3(2 3) S.*

NE 520 Radiation and Reactor Fundamentals. *Preqs: MA 401 and NE 401 or equivalent. 2(2 0) F.*

NE 521 Nuclear Laboratory Fundamentals. *Preqs: MA 401 and NE 401 or equivalent. 3(1 3) F.*

NE 522 Reactor Dynamics and Control. *Preq: NE 401 or NE 520. 3(3 0) S.*

NE 523 Reactor Analysis. *Preqs: NE 401 or NE 520. 3(3 0) F.*

NE 524 Reactor Heat Transfer. *Preq: NE 402 and NE 401 or NE 520. 3(3 0) S.*

NE (MAT) 525 Nuclear Materials. *Preqs: NE 409 or MAT 201. CI. 3(3 0) F.*

NE 526 Radioisotopes Measurement Applications. *Preq: NE 401 or 520. 3(3 0) S.*

NE 527 Nuclear Engineering Analysis. *Preqs: NE 401 or NE 520. 3(3 0) F.*

NE 528 Principles of Fusion Reactors. *Preq: NE 401 or NE 520. 3(3 0) S.*

NE 580 Plasma Generation and Diagnostics Laboratory. *Preq: NE 528 or PY 508 or PY 509. 3(2-3) F. Alt. yrs.*

NE 581 Fusion Energy Engineering. *Preq: NE 528. (3-0) F. Alt. yrs.*

NE 591, 592 Special Topics in Nuclear Engineering I, II. *Preq: CI. 3(3-0) F,S.*

NAVAL SCIENCE (NAVY ROTC)

NS 100 Midshipman 4/C Naval Science Laboratory. *0(0 1) F,S.* Military drill, courtesies and honors, elements of unit leadership, physical fitness and professional development of the prospective Naval Marine Corps Officer. Required of Midshipmen 4 C.

NS 110 An Introduction to Naval Science. *2(2-0) F.* Fundamental orientation to the Naval Service emphasizing the mission, organization, regulations, customs and traditions, broad warfare components of Navy and the major challenges facing today's Navy and Marine Officers.

NS 120 Naval Ships Engineering Systems. *3(3-0).* Introduction to the types, structure and purpose of naval ships. Survey of naval engineering systems with emphasis on marine propulsion and control systems, supporting auxiliary subsystems, ship design and stability and damage control procedures.

NS 200 Midshipman 3/C Naval Science Laboratory. *0(0-1) F,S.* Continuation of NS 100. Required of Midshipmen 3/C.

NS 220 Naval Weapons Systems. *3(3-0).* Theory and principles of operation of naval weapons systems emphasizing types of weapons and fire control systems, capabilities and limitations, theory of target acquisition, identification and tracking, trajectory principles, and basics of naval ordinance.

NS 300 Midshipman 2/C Naval Science Laboratory. *Preq: Junior standing. 0(0-1) F,S.* Continuation of NS 200. Required of Midshipmen 2 C.

NS 310 Navigation. *4(3-2) F.* A comprehensive study of the theory, principles and procedures of ship navigation, movements and employment. Course includes mathematical analysis, spherical triangulations and practical work involving sight reduction, sextant, publications and report logs.

NS 320 Naval Operations. *Preq: Junior standing. 4(3-2) S.* Components of general naval operations, including concepts and application of tactical formations and dispositions, relative motion, maneuvering board and tactical plots, rules of the road and naval communications.

NS 330 Evolution of Warfare. *Preq: Junior Standing. 3(3 0).* A survey of the evolution of warfare through the study of selected campaigns and classic battles with special emphasis on the principles of war, the military impact of leadership, and the evolution of tactics, weapons, and weaponry.

NS 400 Midshipman 1/C Naval Science Laboratory. *Preq: Senior standing. 0(0-1) F,S.* Continuation of NS 300. Required of Midshipmen 1 C.

NS 410 Naval Leadership and Management I. *Preq: Junior standing. 1(1 0) F.* Organizational principles, management theory and leadership styles as they apply in the Navy and Department of Military Defense.

NS 420 Naval Leadership and Management II. *Preq: Senior standing. 1(1 0) S.* Skills and abilities needed for competence as a commissioned officer in the area of human resources management, naval personnel management, material management, and the administration of discipline.

NS 430 Amphibious Warfare. *Preq: Senior standing. 3(3 0) S. Alt. yrs.* A survey of the projection of sea power ashore with special emphasis on the evolution of and innovation in amphibious warfare in the 20th Century through the study of historical amphibious landings and campaigns.

NUTRITION

NTR (ANS, FS) 301 Introduction to Modern Nutrition. *Preq: Sophomore standing. Food science majors may use as a free elective only. 3(3 0) F,S.* Functions, dietary sources and deficiencies of essential nutrients in humans; a balanced diet; role of nutrients in heart disease, cancer, hypertension, osteoporosis; weight control and eating disorders; vegetarianism; food safety; dietary supplements; government regulation of food supply; food quackery. ASH

NTR (ANS, PO) 415 Comparative Nutrition. *Preq: CH 220 or both 221 and 223. 3(3 0) F.* (See Animal Science or Poultry Science.)

NTR (ANS) 419 Human Nutrition in Health and Disease. *Preqs: BCH 451, NTR 415 or FS 400. 3(3-0) F.* Current concepts and physiological bases of the roles of nutrition in the maintenance of health during the different stages in the life cycle and in the prevention and therapy of specific disease states in humans. ASH

NTR 490 Nutrition Seminar. *Preq: Senior standing. 1(1 0) S.* Reviews, analyses and discussions of selected problems of current interest in the field of nutrition and allied sciences. Each student will be required to make at least two oral presentations on subjects of their choosing. Classes will consist of student presentations and outside speakers.

NTR 492 External Learning Experience. *Preq: Sophomore standing. 1-6 F, S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

NTR 493 Special Problems in Nutrition. *Preq: Sophomore standing. 1 6 F.S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

NTR 495 Special Topics in Nutrition. *1 3 F.S.Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

NTR (ANS) 516 Animal Nutrition Research Methods. *Preq: BCH 451 or NTR (ANS) 415 or NTR (ANS) 419 or FS 400. 1-4(0 3) S.*

NTR (FS) 530 Human Nutrition. *Preq: FS 400 or NTR 415 or 419; BCH 451. 3(3-0). All. S.*

NTR (ANS) 540 Ruminant Physiology and Metabolism. *Preqs.: BCH 451 or 551. ZO 421. 3(3 0) F. Even yrs.*

NTR 590 Topical Problems in Nutrition. *Preq: Grad. or senior standing. 1 6 F.S.*

OPERATIONS RESEARCH

Selected 500-Level Courses Open To Advanced Undergraduates

OR 501 Introduction to Operations Research. *Preqs: MA 421 or ST 421 or ST 371 and ST 372. 3(3 0) F.S.*

OR (IE, MA) 505 Linear Programming. *Preq: MA 405. 3(3 0) F.S.*

OR 506 Algorithmic Methods in Nonlinear Programming. *Preqs: MA 301. MA 405. knowledge of computer language, such a FORTRAN or PL1. 3(3-0) F.*

OR (IE) 509 Dynamic Programming. *Preqs: MA 405. ST 421. 3(3 0) S.*

OR (CHE) 527 Optimization of Engineering Processes. *Preqs: CHE 451 or OR 501. FORTRAN programming. 3(3-0) F.*

OR (E, MA) 531 Dynamical Systems and Multivariable Control. *Preqs: MA 301. 405 or equivalent. 3(3 0) F.*

OR (IE) 561 Queues and Stochastic Service Systems. *Preq: MA 421. 3(3 0) F.*

OR (CSC, CSE, ECE, IE) 562 Computer Simulation Techniques. *Preq: ST 516 and a scientific programming language. 3(3-0) F.*

OR (CSC, MA) 585 Graph Theory. *Preq: MA 231 or 405. 3(3-0) F.*

OR 591 Special Topics in Operations Research. *Preq: Cl. 1-3 F.S.Sum.*

PUBLIC ADMINISTRATION

(Also see PS Political Science.)

Selected 500-Level Courses Open To Advanced Undergraduates

PA 511 Public Administration. *Preqs: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.S.Sum.*

PA 520 Environmental Policy. *Preq: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3 0). F.*

PA 573 Computer Applications in Public Administration. *Preq: ST 507; CSC 462 or PS 371. 3(1-6) F.*

PA 574 Data Management in Public Administration. *Prereqs: PS 474 or PA 573 and previous coursework or experience in public administration. 3(3-0) S.*

PA 598 Special Topics in Public Administration. *Prereq: Advanced undergrad. standing including 12 hours in political science, grad. standing or PBS status. 1 6 F,S,Sum.*

PHYSICAL EDUCATION

PE 100 Health and Physical Fitness. *1(0-2) F,S,Sum.* Benefits of a physical fitness training program; training principles, training guidelines, fitness components and misconceptions, nutrition, weight control, stress management, and contemporary health issues.

ACTIVITY COURSES

The following activity courses may be used to fulfill the University physical education requirements. Elective theory courses that do not constitute credit toward meeting physical education requirements are listed below following PE 275.

PE 112 Beginning Swimming. *1(0-2) F,S,Sum.* Swimming skills for the non swimmer that are essential for survival in the water.

PE 113 Advanced Beginning Swimming. *Prereq: PE 112 or equivalent skills. 1(0-2) F,S,Sum.* Continuation of Beginning Swimming; development of basic strokes, learning new strokes, and survival skills.

PE 116 Soccer. *1(0 2) F,S.* Soccer with emphasis on skills development, playing strategies, and rules of the game.

PE 117 Gymnastics. *1(0-2) F,S.* Fundamentals of gymnastics for men and women. Floor exercise, vaulting, parallel and uneven bars, horse, pommel, and spotting.

PE 118 Restricted Activity I. *Prereq: Documentation of medical restriction. 1(0 2) F.* For students who have physical and medical problems and cannot take the regular physical education classes. A course of study is designed in which individual needs and limitations are accommodated.

PE 119 Restricted Activity II. *Prereq: Documentation of medical restriction. 1(0 2) S.* Follows PE 118 for students who require adapted physical activities due to medical and physical limitations.

PE 220 Water Aerobics. *Prereq: PE 112. Individual under medical care must have prior approval from physician before registering for the course. 1(0-2) F,S, Sum.* An individually paced water exercise program designed to increase cardiovascular endurance, muscular strength, muscular endurance, and flexibility. Conducted in waist to chest deep water.

PE 221 Intermediate Swimming. *Prereq: PE 112 or equivalent skill. 1(0 2) F,S,Sum.* Techniques for the front crawl, back crawl, elementary backstroke, breaststroke, and sidestroke, cardiovascular fitness and endurance, water safety techniques.

PE 222 Water Polo. *Prereq: PE 221 or equivalent skills. 1(0 2) F,S.* Fundamental skills of water polo.

PE 223 Lifeguard Training. *Prereq: PE 221 or equivalent skills. 1(0 2) F,S.* Advanced techniques of Lifeguard Training with American Red Cross certification upon completion of course requirements. Optional fee assessed for certification.

PE 224 Water Safety Instructor. *Prereq: Current certification in Lifeguard Training or Emergency Water Safety. 1(0-2) F,S.* Designed to qualify students for a Red Cross Water Safety Instructor's rating. Optional fee assessed for certification.

PE 226 Skin and Scuba Diving I. *Prereq: PE 221 or equivalent skills. 2(0 2) F,S,Sum.* Basic theory and skills related to skin and scuba diving. Emphasis on equipment, diving maladies, safety and physical conditioning for diving. Additional fee assessed for the open water experience and certification.

- PE 227 Scuba Diving II.** *Preq: PE 226 or basic scuba diving certification. A(0-2) F.S.* Scuba skills development, first aid, CPR and open-water rescues.
- PE 228 Springboard Diving.** *Preq: PE 113 or equivalent skills. 1(0-2) F.S.* Individual development of the basic skills of one meter and three meter springboard diving.
- PE 229 Swim Conditioning.** *Preq: PE 113 or equivalent skills. 1(0-2) F.S., Sum.* Improvement of cardiovascular fitness through various aquatic training techniques.
- PE 231 Body Conditioning and Aerobics.** *1(0-2) F.S., Sum.* Instruction in exercise prescription, safety precautions during exercise and proper exercise technique.
- PE 233 Clogging.** *1(0-2) F.S.* Study of traditional and precision clog dancing with emphasis on fundamental skills, combinations and clogging routines.
- PE 234 Country and Square Dance.** *1(0-2) F.S.* Mountain Square Dance, Western Square Dance, and American Country Dances.
- PE 235 Karate.** *1(0-2) F.S.* Traditional (Shotokan) Karate, instruction in basic techniques (kihon) of attacking, blocking, and counterattacking, sparring (kumite), and formal drills (kata). Karate uniform required.
- PE 236 Track and Field.** *1(0-2) F.S.* Develops knowledge and appreciation of, and skill in track and field events.
- PE 237 Weight Training.** *1(0-2) F.S., Sum.* Provides essential knowledge of the principles of muscular strength development and an opportunity to acquire skill in a variety of progressive resistance exercises.
- PE 238 Wrestling.** *1(0-2) F.S.* Wrestling skills, safety considerations, and conditioning factors necessary for moderate competition in a combative sport beginning skills through more advanced techniques.
- PE 239 Triathlon Swim-Bike-Run.** *Preq: PE 221 or equivalent skill and PE 100. 1(0-2) F.S.* Techniques and training that maximize fitness gains and minimize injuries. Bicycles and ANSI approved helmets need to be provided by the students.
- PE 240 Social Dance.** *1(0-2) F.S., Sum.* Basic steps and fundamentals of leading and following in the Fox Trot, Waltz, Cha-Cha, Shag, and one other current popular dance form.
- PE 241 Angling.** *1(0-2) F.S.* Introduction to a variety of casting systems (spinning, bait-casting, fly-casting) and an understanding of inland fishing relating to North Carolina waters. Includes tackle and bait selection, North Carolina laws and regulations, species identification and opportunities for field trips. Fee assessed for North Carolina fishing license.
- PE 242 Badminton.** *1(0-2) F.S., Sum.* Skills development, strategies and rules of singles and doubles play.
- PE 243 Bowling.** *1(0-2) F.S., Sum.* Instruction in ball selection, grip, stance, approach, delivery, bowling etiquette, safety precautions, rules, scoring, terminology, and general theory of spare coverage. Additional fee assessed.
- PE 244 Fencing.** *1(0-2) F.S.* Development of offensive and defensive skills; emphasis on rules, courtesy, and strategy of bouting.
- PE 245 Golf.** *1(0-2) F.S., Sum.* Fundamentals of golf: grip, stance, swing skills. Use of various clubs. Rules and etiquette of play.
- PE 246 Handball.** *1(0-2) F.S.* Skills development, rules and strategies for singles and doubles play.
- PE 247 Roller Skating.** *1(0-2) F.S.* The fundamental and intermediate skills of skating: starting, turning, stopping. Emphasis on balance and coordination with speed work.
- PE 248 Squash.** *1(0-2) F.S.* Skill development and strategies of play. Equipment selection, safety, history, and rules.

PE 249 Tennis I. *1(0 2) F,S,Sum.* Basic tennis skills of grips, footwork, groundstrokes, service. Rules and basic strategy for singles play. Introduction to volleys, lobs, overheads, and doubles.

PE 250 Tennis II. *Preq: PE 249 or equivalent skills. 1(0-2) F,S.* Review of tennis skills and refinement of grips, footwork, groundstrokes, service, rules, and basic strategies of singles and doubles. Emphasis on volleys, lobs, overheads, supplemental shots, active drills, and playing situations.

PE 251 Target Archery. *1(0 2) F,S,Sum.* Shooting fundamentals. Safety, selection, and care of equipment.

PE 252 Downhill Skiing. *1(0-2) S.* Fundamentals, safety, equipment selection and care, straight runs, turns, and slalom. Offered in January (semester break) at a ski site selected by the Department, with organizational meeting and three class meetings on campus prior to the trip. University preregistration unnecessary. Additional fee assessed.

PE 253 Orienteering. *1(0-2) F,S.* Navigating on foot defined point to defined point, with use of map and compass in the shortest possible time.

PE 254 Beginning Equitation. *1(0 2) F,S.* Hunt seat equitation, care of horse and tack, and control skills at the walk, trot and canter. Meets off campus once a week. Additional fee assessed.

PE 255 Canoe Tripping. *Preq: PE 112 or equivalent skills. 1(0-2) F,S.* Instruction and experience in flat water canoe tripping skills emphasizing paddling skills, river travel techniques, safety, minimal impact camping techniques and proper equipment selection. Plan and participate in two required weekend field trips. Optional fee assessed for certification.

PE 256 Racquetball. *1(0-2) F,S,Sum.* Skills development, strategies and rules of singles and doubles play.

PE 257 Backpacking. *1(0 2) F,S.* Designed for students with little or no backpacking experience. Safe and environmentally-sound camping practices. Equipment/clothing, first aid and safety management agencies, land navigation, and trip planning. Two weekend field trips required.

PE 258 Basic Rock Climbing. *1(0-2) F,S,Sum.* Instruction and direct experience for the beginning rock climber. Emphasis is on safe rope systems for belaying and basic movement on rock.

PE 259 Intermediate Rock Climbing. *Preq: PE 258 or equivalent skills. 1(0 2) F,S.* Development of intermediate rock climbing skills, including partner and self rescue, lead climbing, training systems and field trip opportunities. Additional fee assessed.

PE 260 Intermediate Equitation. *Preq: Beginning Equitation or equivalent. 1(0 2) F,S.* Advanced techniques, theories and performance in equitation. Additional fee assessed.

PE 261 Basketball. *1(0-2) F,S.* Skill development. Offensive and defensive systems of team play. History and rules of the sport.

PE 262 Introduction to Whitewater Canoeing. *Preq: PE 255 or equivalent; ability to pass swim test. 1(0-2) F,Sum.* Instruction and direct experience in fundamental whitewater canoeing skills. Basic paddling strokes and maneuvers for use on whitewater, river safety, basic river rescue, equipment selection and care, and environmental ethics. Additional fee assessed.

PE 263 Tap Dance. *1(0-2) F,S.* Fundamentals of tap dance. Emphasis on basic rhythmic exercises, traveling steps, and tap routines.

PE 264 Ballet. *1(0 2) F,S.* Fundamentals of ballet. Emphasis on barre technique, exercises, steps Au Milieu (center work without barre), and steps Allegro.

PE 265 Softball. *1(0-2) F,S,Sum.* Basic skills, rules, and strategies for playing softball.

PE 266 Ultimate Frisbee. *1(0 2) F,S.* Emphasis on skill development and competition. Includes flight dynamics, throwing, catching, offensive skills, defensive skills, equipment, and rules of the game.

PE 267 Flag Football. *1(0 2) F,S.* An introduction to the skills, history, rules and strategy of flag football.

PE 268 Advanced Clogging. *Preq: PE 233 or equivalent. 1(0 2) F,S.* Experience in advanced Appalachian clogging techniques.

PE 269 Volleyball I. *1(0 2) F,S, Sum.* Volleyball fundamentals: setting, passing, serving, spiking, court movement, and game strategy.

PE 270 Volleyball II. *Preq: PE 269 or equivalent. 1(0-2) F,S.* Advanced techniques, theories and strategies of volleyball.

PE 271 Varsity Sports. *Preq: 1 hr. of P.E. credit. 1 F,S.* For students participating in a varsity sport during that sport's scheduled season.

PE 273 Jazz Dance. *1(0 2) F,S.* Modern jazz styles through instruction in beginning jazz skills and combinations. Reduction of inhibition and development of creativity and free movement.

PE 274 Modern Dance I. *1(0-2) F,S.* Fundamental techniques of movement and dance, theory and history of modern dance as an art form, improvisation and composition, structured dance exercises, and dance combinations.

PE 275 Modern Dance II. *Preq: PE 274 (or permission of instructor). 1(0 2) F,S.* Continuation of Modern Dance I. Clarification of design of body in space, dance movement qualities and phrasing, performance of phrases of repertory materials.

PE 276 Whitewater Rafting. *Preq: Pass swim test. 1(0-2).* Whitewater rafting skills and practices emphasizing safe river travel, minimal impact river camping techniques, and trip planning. Additional fee assessed.

ELECTIVE THEORY COURSES

The following courses do not constitute credit toward meeting the University physical education requirements.

PE 201 Coaching Baseball/Softball. *2(2 0) S.* Theories, techniques, and strategies of coaching baseball/softball.

PE 202 Coaching Basketball. *2(2-0) F.* Theories, techniques, and strategies of coaching basketball.

PE 203 Coaching Football. *2(2 0) F.* Theories, techniques, and strategies of coaching football.

PE 204 Coaching Golf. *2(2-0) S.* Theories, techniques, and strategies of coaching golf.

PE 205 Coaching Soccer. *2(2 0) F.* Theories, techniques, and strategies of coaching soccer.

PE 206 Coaching Swimming and Diving. *2(2-0) S.* Theories, techniques and strategies of coaching swimming and diving.

PE 207 Coaching Tennis. *2(2-0) S.* Theories, techniques, and strategies of coaching tennis.

PE 208 Coaching Track & Field/Cross-Country. *2(2-0) S.* Theories, techniques, and strategies of coaching track and field and cross country.

PE 209 Coaching Volleyball. *2(2 0) F.* Theories, techniques, and strategies of coaching volleyball.

PE 210 Coaching Wrestling. *2(2-0) S.* Theories, techniques, and strategies of coaching wrestling.

PE 277 Coaching Concepts. 3(3 0) F,S. Theoretical and practical concepts involved in coaching preparation. Practical knowledge necessary in applying these concepts.

PE 278 Principles of Sports Science. 3(3-0) F,S. Basic principles of human anatomy, physiology, and biomechanics and their relationship to athletic coaching.

PE 279 Introduction to Sport Management. 2(2 0) F,S. Philosophies, theories, and techniques for planning, organizing, and managing scholastic sport programs.

PE 301 Coaching Practicum. *Preq: 15 hours of PE. 1(0 4) F,S.* A seven week practical coaching experience in a junior high school or high school setting. Specific placement will depend upon the various playing seasons for the sports involved.

HEALTH STUDIES COURSES

The following courses do not constitute credit toward meeting the University physical education requirements.

PEH 212 Alcohol, Drugs and Tobacco. 2(2-0) F,S. Overview of physiological and psychosocial aspects of drug use and abuse in modern society. Emphasis placed on practical application of course material to promote healthy lifestyle changes. Trends in drug education prevention/treatment explored.

PEH 213 Human Sexuality. 2(2-0) F,S,Sum. Physiological and psychosocial aspects of human sexuality. Emphasis placed on health-related topics of birth control, pregnancy, childbirth, abortion and sexually-transmitted diseases. Concepts of gender acquisition, sexual values, and sexual morality discussed as related to the promotion of healthy lifestyles within contemporary American culture.

PEH 280 Responding to Emergencies. 2(2 0). F,S,Sum. Does not satisfy the physical education requirement. Information necessary to evaluate vital signs and bodily functions as related to emergency response; training to evaluate and react correctly to most emergency situations which might arise, and to perform temporary medical care and the follow up action as indicated. Optional fee assessed for certification.

PEH 285 Personal Health. 2(2 0) F,S. A lecture discussion course with emphasis on personal health including mental health, alcoholism, drugs, sexuality, nutrition, family health, diseases, health quackery and health practitioners.

PEH 281 Introduction to Athletic Training. *Preq: PE 280. 3(2-3) S.* Examines the incidence, causes, prevention and treatment of sports related injuries. Stresses conditioning for sports, injury recognition and evaluation, taping techniques, first-aid care, treatment, and reconditioning.

PEH 286 Nutrition, Exercise and Weight Control. 2(1-2) F,S. A weight control program that emphasizes knowledge of nutrition, controlled eating habits and exercise. Individual weight loss prescribed.

PHILOSOPHY

(Also see REL - Religion)

PHI 201 Logic. 3(3 0) F,S,Sum. Introduction to the methods of deductive inference. Concepts of validity and implication defined and applied to statements and arguments.

PHI 205 Problems and Types of Philosophy. 3(3-0). Introduction to selected problems of enduring philosophical importance, including such topics as the nature of morality, knowledge, human freedom, and the existence of God. Content varies with different sections.

PHI 250 Practical Reasoning. 3(3-0). Analysis and criticism of both deductive and inductive argument. Deduction validity and soundness in deductive arguments; definition and the clarification of meaning; disproof by counter example; common fallacies. Inductive arguments: polls and samples; correlations and causal connection. Conceptual and empirical theories and hypotheses. Arguments discussed with a minimum of formalization.

PHI 275 Ethics. *3(3-0)*. An examination of the traditional questions of philosophical ethics: What sort of life is worthy of a human being, and what are the principles of moral conduct? Both classic and contemporary literature will be studied.

PHI 298 Special Topics in Philosophy. *3(3-0)*. Selected studies in philosophy that do not appear regularly in the curriculum. Topics will be announced for each semester in which the course is offered.

PHI 300 Early Western Philosophy. *3(3-0)*. History of western philosophy of the ancient world and Middle Ages, with special emphasis on Plato and Aristotle.

PHI 301 Modern Western Philosophy. *3(3-0)*. A critical survey of selected works of major Western philosophers of the 17th and 18th centuries: Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and Kant.

PHI 305 Philosophy of Religion. *3(3-0)*. The existence and nature of God, including such topics as traditional proofs of God, skeptical challenges to religious belief, miracles, the problem of evil, faith and reason, and religious experience.

PHI 306 Philosophy of Art. *3(3-0) S,Sum*. Analysis of the concepts and theories encountered in discussion of art in such a way as to illuminate the nature of works of art, esthetic experiences, and art criticism.

PHI 309 Contemporary Political Philosophy. *3(3-0)*. Current theories about basic concepts in political philosophy, such as liberty, equality, justice, natural rights, and democracy, with special attention to disputes concerning the nature of a just social order.

PHI 311 Philosophical Issues in Medical Ethics. *3(3-0)*. Such issues as the morality of abortion, suicide, and euthanasia; the meaning and function of the concepts of health, illness, and death; psychological intervention; paternalism in medicine; consent and medical experimentation; and the allocation of scarce medical resources. Consideration of individual rights and fairness. Emphasis on conceptual clarity and the assessment of moral principles.

PHI 312 Philosophy of Law. *3(3-0) F*. Fundamental issues concerning law such as what makes something a law or legal system and when legal interference with individual liberty is justified. Each philosophical issue tied to particular legal cases.

PHI 313 Ethical Problems in the Law. *3(3-0)*. Explores the uses of the legal system, including such topics as the death penalty, plea bargaining, legalizing euthanasia, censorship, Good Samaritan laws, the insanity defense, civil disobedience, and preferential treatment.

PHI 314 Issues in Business Ethics. *3(3-0)*. An analysis and evaluation of major issues in business ethics. Topics include the social responsibility of business; social justice and free enterprise; the rights and duties of employers, employees, manufacturers, and consumers; duties to the environment, the world's poor, future generations, and the victims of past injustices; the moral status of the corporation; and the ethics of advertising.

PHI 321 Contemporary Moral Issues. *3(3-0)*. Philosophical analysis and theory applied to a broad range of contemporary moral issues, including euthanasia, suicide, capital punishment, abortion, war, famine relief, and environmental concerns.

PHI 322 Philosophical Issues in Environmental Ethics. *3(3-0)*. Arguments and principles surrounding moral questions about the environment: whether non humans have moral standing; duties to future generations; policy regarding population, common resources, pollution; preserving biodiversity, forests; property rights; efficiency and equity considerations; decision-making associated with global risk taking, e.g., global warming.

PHI 323 Nuclear Arms: Philosophical Issues. *3(3-0)*. Alternative theories of rational decision making and morality considered in the context of the nuclear arms race.

PHI 325 Theories of Human Nature. *3(3-0)*. Philosophical and scientific theories of human nature, with special attention to "nature/nurture" controversies. Detailed treatment of one of two contemporary issues, such as IQ, sociobiology, gender differences, or abortion, in which the question "what is a human being?" plays a central role.

PHI 330 Metaphysics. *3(3 0) S.* Metaphysical problems: distinction between appearance and reality, nature of space and time, free will and determinism, mind and body, nature of identity.

PHI 331 Philosophy of Language. *3(3-0).* Introduction to traditional and modern accounts of the relations between language and reality. The nature of truth and linguistic meaning, the unique character of human knowledge of natural language, and problems of intentionality.

PHI 332 Philosophy of Psychology. *3(3-0).* Problems and controversies that overlap the boundary between philosophy and psychology: the mind/body problem, behaviorism vs. cognitivism, the prospects for artificial intelligence, and language and the question of innate knowledge.

PHI 333 Theory of Knowledge. *3(3 0).* Analysis of such central concepts as knowledge, belief, and truth, and the investigation of the principles by which claims to knowledge may be justified.

PHI 335 Symbolic Logic. *3(3 0).* Introduction to modern symbolic logic. Examination of the procedures for translating certain sentences into logical notation and for manipulating that notation to produce correct inferences. Also introduction to mathematical study of logic; properties of the symbolic system itself.

PHI 340 Philosophy of Science. *3(3-0).* Character and function of explanation in scientific activity, concepts of law and theory, role of inductive confirmation, and relationship between natural and social sciences.

PHI (PSY) 425 Introduction to Cognitive Science. *Prereq: One upper-level course in either PHI, PSY, CSC or Linguistics. Credit cannot be given for both PHI (PSY) 425 and PHI (PSY) 525. 3(3-0).* Philosophical foundations and empirical fundamentals of cognitive science, an interdisciplinary approach to human cognition. Topics include: the computational model of mind, mental representation, cognitive architecture, the acquisition and use of language.

PHI 498 Special Topics in Philosophy. *Prereq: Six credits in PHI. 1 6.* Detailed investigation of selected topics in philosophy. Topics determined by faculty members in consultation with head of the department. Course may be used for individualized study.

PHYSIOLOGY

Selected 500-Level Courses Open To Advanced Undergraduates

PHY (ANS) 502 Reproductive Physiology of Vertebrates. *Prereq: ZO 421. 3(3 0) F.*

PHY (ZO) 503 General Physiology I. *Preqs: Sr. or grad. standing; ZO 421 and BCH 451. 3(3-0) F.*

PHY (ZO) 504 General Physiology II. *Preqs: Sr. or grad. standing and PHY 503. 3(3-0) S.*

PHY (ZO) 513 Comparative Physiology. *Prereq: ZO 421 or CI. 3(3 0) F. Odd yrs.*

PHY (ANS) 580 Mammalian Endocrine Physiology. *Preqs: BCH 451, ZO 421. 3(3-0) S. Even yrs.*

PHYSICAL AND MATHEMATICAL SCIENCES

PMS 100 Orientation to Physical and Mathematical Sciences. *Prereq: Undergraduate in College of PAMS. 1(1 0) F.* Introduction to scope and objectives of University education. Emphasis on academic skills as related to academic success. Career discussions, guest lectures, site trips. Departmental advising components.

PMS 110 Physical and Mathematical Sciences Scholars Forum. *Preq: Enrollment limited to participants in the PAMS Scholars Program. 0(2-0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

PMS 210 Physical and Mathematical Sciences Scholars Forum. *Preq: Enrollment limited to participants in the PAMS Scholars Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

POULTRY SCIENCE

PO 201 Poultry Science and Production. *Preq: BS 100. 4(3-3) F,S.* Fundamental principles of broiler, turkey and egg production including poultry physiology, breeding, incubation, housing, nutrition, disease control, management and marketing. PARKHURST

PO 301 Evaluation of Live Poultry. *Preq: PO 201. 2(1-3) S.* Experience in evaluating live poultry for production and breeder stock potential. Emphasis on techniques and criteria used in selecting poultry for use in commercial production units. PARKHURST

PO (ANS, FS) 322 Muscle Foods and Eggs. *Preq: BS 100. 3(2-3) F.* Processing and preserving fresh poultry, red meats, seafoods, and eggs. Ante- and post-mortem events as they affect quality, yield and compositional characteristics of muscle tissues. LARICK

PO 351 Grading and Evaluation of Poultry Products. *Preq: PO 201. 2(1-3) F.* Principles of grading and evaluation of poultry products such as dressed broilers, turkeys, shell eggs, candled eggs and broken-out eggs according to USDA guidelines. PARKHURST

PO 405 Avian Physiology. *Preq: CH 220. 4(3-3) F.* The principles of avian physiology integrating the physiological processes and the associated anatomical structures that insure the homeostatic state in birds. EDENS

PO 410 Production and Management of Game Birds in Confinement. *Preq: PO 201. 3(2-3) S.* Management principles associated with the successful propagation and rearing of game birds, ornamental birds and waterfowl in confinement. Housing and pen requirements, nutrition, disease control and regulatory issues included. PARKHURST

PO (ANS, NTR) 415 Comparative Nutrition. *Preq: CH 220 or 221 and 223. 3(3 0) F.* Principles of nutrition, including the classification of nutrients and the nutrient requirements of and metabolism by different species for health, growth, maintenance and productive functions. DONALDSON

PO 420 Turkey Production. *Preq: PO 201. 2(1-2) S.* Principles and current practices of turkey production. CHRISTENSEN

PO 422 Incubation and Hatchery Management. *Preq: PO 201. 2(1-2) F.* Principles and current practices of incubation and hatchery management. BRAKE

PO 423 Broiler Production. *Preq: PO 201. 2(1-2) F.* Principles and current practices of broiler production; encompassing nutrition, management, poultry health and related areas. PARKHURST

PO 490 Poultry Seminar. *Preq: Sr. standing. 1(1-0) F.* Topics related to current and future problems in poultry science and the poultry industry. Resume writing and interviewing for permanent positions are outlined by faculty and qualified guest lecturers from the poultry industry. Students participate in mock interviews. PARDUE

PO 492 External Learning Experience. *Preq: Sophomore standing. 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

PO 493 Special Problems in Poultry Science. *Preq: Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

PO 495 Special Topics in Poultry Science. *1 3 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

PO 505 Physiological Aspects of Poultry Management. *Preqs: PO 201, PO 405 or grad. standing. 3(3 0) S.*

PO (GN) 520 Poultry Breeding. *Preq: GN 411. 3(2 2) S.*

PO (ZO) 524 Comparative Endocrinology. *Preq: ZO 421 or equivalent. 4(3-3) S.*

PLANT PATHOLOGY

PP 315 Principles of Plant Pathology. *Preq: BS 100. 4(3 3) S.* Induction, development and nature of plant diseases caused by fungi, bacteria, viruses, parasitic plants and abiotic factors. Physiological and ecological aspects of host pathogen biology, and relationship among cultural practices, host resistance, and pesticides in disease control.

PP (FOR) 318 Forest Pathology. *Preq: BS 100 or equivalent. 4(3 2) S.* Major types of diseases of forest trees and deterioration of wood products are studied emphasizing: principles of plant pathology; symptomatology and diagnosis; nature of disease causing agents; physiology, ecology and dissemination of disease-causing agents; mechanisms of pathogenesis; epidemiology and environmental influences; principles and practices of control.

GRAND

PP 492 External Learning Experience. *Preq: Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

PP 493 Special Problems in Plant Pathology. *Preq: Sophomore standing. 1 6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

PP 495 Special Topics in Plant Pathology. *1-3 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for offering of new courses on a trial basis.

Selected 500-Level Courses Open To Advanced Undergraduates

PP 501 Phytopathology I. *Preq: PP 315 or equivalent. 5(3-6) F.*

PP 515 Epidemiology and Plant Disease Control. *Preq: PP 315 or PP 318. 3(3-0) S.*

PP (MB, BO) 575 The Fungi. *Preq: BO 200 or equivalent. 3(3 0) F.*

PP (MB, BO) 576 The Fungi-Lab. *Coreq: BO 575. 1(0-3) F.*

PP 595 Special Problems in Plant Pathology. *Preq: CI. Credits Arranged, Maximum 6.*

PARKS, RECREATION, AND TOURISM MANAGEMENT

PRT 101 Recreation Resources Orientation Laboratory. *1(0 3) F.S.* Introduction to the profession of park, recreation and tourism services and to the career opportunities in the delivery of these services. LOVE

PRT 152 Introduction to Recreation. *3(3 0) F.S.Sum.* Introduction to the professional field of recreation by presenting the basic principles, fundamentals and concepts of recreation as related to such factors as: recreation history and objectives, sociological and economic aspects of recreation, leadership qualities and facility provision; and settings for organized recreation in modern society. MOORE, WARREN

PRT 200 Exploring Leisure Alternatives. *3(3-0) F.S.Sum.* Leisure as a lifelong resource for human satisfaction and fulfillment; its potential for physical, mental, social and emotional growth and development of the individual. Leisure opportunity areas presented and evaluated. LOVE

PRT 215 Park and Recreation Maintenance Management. *Preq: PRT 152. 3(3 0) F.* Maintenance management of park, recreation and leisure service facilities for public use; maintenance job planning and scheduling; preventive maintenance; current maintenance materials and equipment. WARREN

PRT 216 Managing Park and Recreation Facilities. *Preq: PRT 152. 3(3-0) S.* Managing aquatic recreation resources including swimming pools, beaches, large and small lakes, marinas, and rivers; family campgrounds and golf courses. WARREN

PRT 220 Commercial Recreation and Tourism. *Preq: PRT 152. 3(3-0) F.* Commercial recreation and the tourism industry, including its origin, present characteristics, behavioral foundations, and societal impacts. Emphasis on recreation administration in the commercial sector. BROTHERS, GUSTKE

PRT 320 Convention and Visitor Services. *Preq: PRT 152. 3(3 0) Every third semester.* Programmatic issues of facilitating conventions, visitor services and special events, including convention operations, development and operation of visitor service programs, and special event programming. GUSTKE

PRT 350 Outdoor Recreation Management. *Preq: PRT 152. 3(2 3) F.* Concepts and methods of outdoor recreation planning and management explored with emphasis on the public sector. Current issues relative to recreation provision identified and debated. MOORE, DEVINE

PRT 353 Camp Administration. *3(2 2) S.* Development of organized camping emphasis on the administration of resident camping programs. Educational and recreational objectives of camping. Program planning, leadership training, and administration of camps. Laboratory provides for application of camping principles. WARREN

PRT 358 The Recreation Program. *Preq: PRT 152. 4(2 4) F.* Theoretical and applied approaches to the recreation program planning process. Basic elements of programming using a variety of recreational settings and diversity of practical experience. LOVE, WILSON

PRT 359 Leadership and Supervision in Recreation. *Preqs: PRT 215, PRT 216. 3(2-2) S.* Development of awareness skills in leadership, group dynamics, human relations and employee supervision in the delivery of recreation services.

PRT 365 Arts Management in Recreation. *Preq: Junior standing. 3(2-2) F.* Introduction to arts management in recreation programs; emphasis on the importance and benefits of arts to the individual and community. Understanding and appreciation of the role of the arts in a comprehensive recreation program plan. Emphasis on arts management principles including philosophy, fiscal, technical and physical community resources. WILSON

PRT 366 Administration of Recreation Sports. *Preq: PRT 358. 3(3-0) S.* General concepts and desirable practices for the effective management of community recreation sports programs. Techniques required for the identification and solution of problems usually associated with community sports programs. LOVE

PRT 420 Resort Management and Operations. *Preq: PRT 152. 3(3 0) Every third semester.* Theory and practical applications of planning, accommodations management, food and beverage operations, recreation programs, and management in the resort industry.

BROTHERS, GUSTKE

PRT 438 Recreation for Special Populations. *Preq: PRT 358. 3(3 0) F.* Leisure concerns of deprived groups. Status, problems and community service needs of special populations found in most American communities. Special populations include the physically disabled, the mentally retarded, the aging and the economically deprived.

PRT 442 Recreation and Park Interpretive Services. *Preq: Junior standing. 3(2 3) F.* The principles and practices of environmental and historical interpretation. Personal (attended) and non-personal (unattended) interpretive communication techniques. Comprehensive planning and implementation of interpretive programs, and equipment and facilities used in environmental and historical interpretation. One overnight field trip required. WILSON

PRT 443 Applied Recreation and Park Interpretive Services. *Preqs: PRT 442, Junior standing. 3(1 6) S.* Development, implementation and evaluation of interpretive communication techniques as applied to historic and natural resources. WILSON

PRT 451 Principles of Recreation Planning and Facility Development. *Preq: PRT 358. 3(2-3) S.* Planning activities analyzed as decision making processes. Identification, interpretation, evaluation and utilization of data and resources necessary for recreation planning. Planning principles applied in the analysis of proposed and existing recreation sites. BROTHERS, REA

PRT 453 Administrative Processes of Recreation/Park Organizations. *Preq: PRT 359. 3(3-0) F.* Basic administrative processes; the internal organization of the recreation park department; board and executive relationships; legal foundations and legal liability considerations; personnel practices and policies; and public relations administration.

PRT 454 Recreation and Park Finance. *Preqs: Six hours PRT, senior standing. 3(3 0) S.* Recreation and park fiscal administration; sources of finance for operating and capital expenditures, revenue activities, financial planning, budgeting, expenditure policies, auditing and planning for recreation and park services.

PRT 475 Recreation and Park Internship. *Preqs: PRT 358, PRT 359 and senior standing. 8(0-27) F,S,Sum.* Provides prospective park, recreation and leisure service professional a 400-hour (ten-week) learning experience in a selected agency or organization, under the joint supervision of a qualified manager and a university internship supervisor.

PRT 476 Post-Internship Seminar. *Preq: PRT 475. 1(0 2) F,S,Sum.* Identification and analysis of current management practices, challenges and issues common to leisure delivery systems.

PRT 480 Recreation Analysis and Evaluation. *Preqs: ST 311, PRT 359. 3(2 2) F,S.* Examination of the steps involved in analyzing and estimating the impact of recreation and parks services. Includes relevant issues and useful approaches for systematic analysis. Emphasis is placed on an understanding and development of various types of systematic evaluation designs. Activities leading to the analysis and development of performance reports to assess and improve managerial operational efficiency are covered. SIDERELIS

PRT 491 Special Topics in Recreation. *Preq: Consent of department. 1 3 F,S,Sum.* Investigation and analysis of a problem associated with recreation resources.

Selected 500-Level Courses Open To Advanced Undergraduates

PRT 500 Theories of Leisure and Recreation. *Prq: Nine hours of PRT courses. 3(3 0) F.*

PRT 501 Research Methods in Recreation. *Prqs: ST 311 and nine hours of PRT courses. 3(3 0) S.*

PRT (EB) 503 Economics of Recreation. *Prq: EB 301 or 401. 3(3 0) F.*

PRT 504 Recreation and Park Data Systems. *Prqs: CSC 200, ST 311; Coreq: PRT 453. 3(3-0) F.*

PRT 505 Quantitative Techniques for Recreation and Natural Resource Management. *Prqs: CSC 200, ST 311. 3(3-0) S.*

PRT 510 Theories of Sport and Fitness Program Management. *Prq: PRT 358. 3(3-0) Every third semester.*

PRT 511 Foundations for Sport, Exercise and Fitness Program Management. *Prq: PRT 358. 3(3-0) Every third semester.*

PRT 512 Recreational Sports Management. *Prq: PRT 358. 3(3 0) Every third semester.*

PRT 591 Recreation Resources Problems. *Prq: Advanced undergrad. or grad. status. 1 4 F.S.*

POLITICAL SCIENCE

(Also see PA Public Administration)

PS201 Introduction to American Government. *3(3 0) F.S. Sum.* The American federal system, integrating national and state governments, with emphasis on constitutional principles, major governmental organs, governmental functions, and the politics and machinery of elections. Some attention to other types of political systems, and comparisons made where relevant.

PS 202 State and Local Government. *3(3 0). F.S. Sum.* State and local governments within the context of the American federal system. Special emphasis on federalism, the constitutional legal relationships between state and local governments, and the institutions, organizational forms, and political processes in American state and local government. **McCLAIN, WILLIAMS**

PS 204 Problems of American Democracy. *3(3 0) Alt. yrs.* Political problems in America from the perspective of political theory. Democracy, economics and politics, racial and sexual equality, civil disobedience, and individual freedom. **KESSLER**

PS 231 International Relations. *3(3 0) F.S. Sum.* General patterns and attempted control of political interrelationships in the modern state system with emphasis on developments since World War II. Major focus on American and Soviet perceptions of the world, on their foreign policies, and on the increasing impact of Third World nations. **GRIFFIN, KEBSCHULL**

PS 236 Issues in Global Politics. *3(3-0). S.* Major problems confronting the world community, political issues that they raise, and ways in which they are being addressed internationally. Problems include those related to poverty and economic development of the Third World; to population, food resources, the environment; and to wars, arms races, and arms control. **SOROOS**

PS 241 Introduction to Comparative Politics. *3(3-0).* Introductory comparative analysis of a selected variety of political systems always including some developed democracies, some communist states and some developing countries. A minimum familiarity with the American political system is assumed. **KEBSCHULL**

PS 250 Principles of Political Science. *3(3 0)*. Survey of the nature and varieties of political behavior; concepts and theories of political science; the sources of political science information; and the comparative characteristics of political behavior and institutions both within and among nation states. KEBSCHULL

PS 298 Special Topics in Political Science. *3(3 0)*. Utilized for experimental courses at the sophomore level.

PS 301 The President and Congress. *Prereq: PS 201. 3(3 0) F,S,Sum*. The relationship between the President and Congress in the making of public policy with emphasis on the constitutional, institutional, partisan and personal bases for cooperation and conflict between the two. Emphasis on presidential-legislative interactions in a number of public policy fields. HOLTZMAN

PS 306 Law and Courts in the American Political System. *3(3-0) F,S*. The role of state and federal courts in the political system, including: structure, court organization and legal personnel; the nature of law and its role in society; and functions performed by courts in the political system, from dispute settlement to the initiation of social change. REID, RUBIN

PS 307 Introduction to Criminal Law in the United States. *3(3 0) F,S*. Principles underlying the criminal law in the United States and classification of crimes, the criminal act, criminal act, factors affecting criminal responsibility and various types of offenses. Observation of state and federal court sessions. RUBIN

PS 308 Supreme Court and Public Policy. *3(3-0) F,S*. The role of the Supreme Court in American politics, with emphasis on the use of litigation as a form of political activity. Readings include relevant court cases as well as descriptions of the Supreme Court in action. REID, RUBIN

PS 310 Public Policy. *3(3-0)*. Introduction to public policy formulation and analysis, including agenda-setting strategies, problems of legitimization, the appropriations process, implementation, evaluation, resolution, and termination. PAVLIK, O'SULLIVAN

PS 311 Criminal Justice Policy Process. *3(3-0) F,S*. Formulation and implementation of policies in various criminal justice institutions. Police agencies, solicitors' offices, courts, prisons and probation and parole departments as public bureaucracies, and interactions of key officials. MOOG

PS 312 Introduction to Public Administration. *Credit for both PS 312 and PS 511 is not allowed. 3(3 0) F,S*. Administration in city, state and national governments: effectiveness and responsiveness, involvement in policy areas, and issues of ethics and responsibilities. McCLAIN, COE

PS 314 Science, Technology and Public Policy. *3(3 0)*. Societal impacts of current science and technology. United States and foreign governmental policy processes and responses. The role of science and technology in alleviating resource scarcities. A comparison of domestic with international science and technology issues.

PS 320 United States Environmental Politics. *3(3 0) S*. Emergence of the environment as an issue in United States politics. Law and policy pertaining to air and water pollution, land use, water, energy, toxic substances, and wilderness. Roles of national and state governments, scientists, corporations, and citizens groups in addressing environmental problems. Contemporary thought on political ecology.

PS 331 U.S. Foreign Policy. *3(3 0) F,S,Sum*. The content, formulation, and execution of U.S. foreign policy during the postwar period, with concentration on major issues and trends, the instruments for implementing foreign policy, and analysis of the policy-making process. GILBERT

PS 332 Soviet Foreign Policy. *3(3-0) S*. Content, formulation, and execution of Soviet foreign policy since World War II; major issues and trends of the postwar period, the policy-making process, and the institutions responsible for implementing foreign policy. MASTRO

- PS 336 Global Environmental Politics.** *3(3-0) F.* Political aspects of global ecological problems, particularly population, food, energy, minerals, renewable resources, pollution, and extinction of species. Relevant national and international policies, including management of oceans, the seabed, Antarctica, and outer space. **SOROSS**
- PS 342 Political Systems of China and Japan.** *3(3-0).* A comparative analysis of the structure and processes of politics in China and Japan. **WILLIAMS**
- PS 343 Southeast Asia: Internal Politics and External Relations.** *3(3 0).* Domestic and international politics in the region from Burma to the Philippines. Contemporary issues involving relations among Vietnam, ASEAN, China, Japan, the USSR, and the USA in the context of the internal political dynamics of the ten countries of Southeast Asia.
- PS 344 Soviet Politics.** *3(3-0) F.* Contemporary Soviet political system with consideration given to the historical and ideological base of Soviet politics, comparisons with other political systems. **MASTRO**
- PS 345 Governments and Politics in the Middle East.** *3(3 0).* Contemporary politics of the Middle East. Emphasis on the historical, geographic, religious, and political economic factors of the region and the individual countries. Attention to the foreign policies of the superpowers in the region as well as to the Arab-Israeli conflict, Middle Eastern oil, and revolutionary developments in Iran and elsewhere. **MOOG**
- PS 346 Comparative Political Systems of Asia.** *Preq: PS 201. 3(3-0) F, Sum.* Comparative political systems of selected Asian countries; political structures, current problems and future prospects that face these countries in their bid to modernize in a traditional setting.
- PS 361 Introduction to Political Theory.** *3(3 0) F.* Basic questions about the nature and purpose of politics, as treated by such writers as Plato, Aristotle, St. Augustine, Machiavelli, Locke, Rousseau, Tocqueville, Marx, and Nietzsche. **KESSLER**
- PS 362 American Political Thought.** *3(3-0) S.* American ideas and institutions as viewed from the perspective of great American political thinkers, including Thomas Jefferson, James Madison, Alexander Hamilton, Henry David Thoreau, Abraham Lincoln, Franklin Roosevelt, Frederick Douglass, and Malcolm X. **KESSLER**
- PS 371 Research Methodology of Political Science.** *Preq: PS 201. 3(3-0) F, S.* Principles and procedures of political science research including the philosophy of science; theory construction; sampling, measurement and research designs; computer applications, main frame and microcomputing. **O'SULLIVAN, VASU, WILLIAMS**
- PS 401 American Parties and Interest Groups.** *3(3-0) F.* Impact of American political system upon parties and interest groups; their influence upon that system. American parties and interest groups as instruments for mobilizing electorates, choosing and organizing government leaders, affecting public policy and administration. Strategies, tactics and problems of American parties and interest groups. **HOLTZMAN**
- PS 402 Campaigns and Elections in the U.S. Political System.** *Preq: PS 201. 3(3 0).* Campaigns and elections in the United States with emphasis on presidential and congressional primary and general elections. Development of theoretical propositions concerning how and why people vote, how and why candidates campaign, and behavioral reasons underlying candidates' successes and failures. Special emphasis on the role of the mass media in the electoral process. **DORFF**
- PS 406 American State Politics.** *3(3-0).* Comparative study of the politics and policies of the fifty American states. Socioeconomic and political variations and state response to intergovernmental domestic programs. Analysis of state policy in economic development, environment, health, housing, education, transportation, criminal justice and regulation. **McCLAIN, WILLIAMS**

PS 408 Urban Politics. *3(3 0).* An introduction to politics and policies in urban areas. Topics include comparisons among rural and urban areas, various regions of the U.S., and communities of varying size. The course embodies both an intergovernmental and a policy approach. Policy topics included are planning and growth management, education, housing, welfare, health, transportation, environmental and energy issues, and public safety.

SVARA

PS 411 Public Opinion and the Media in American Politics. *Preq: PS 201. 3(3 0) F,S Alt. yrs.* Nature, content, origins, and effects of public opinion in the American political system; role of the mass media in articulating and shaping public opinion; issues concerning measurement of public opinion.

DORFF, VASU

PS (SOC) 413 Criminal Justice Field Work. *Preqs: Acceptance in criminal justice option; senior standing; SOC 306 and PS 311. 4(2 8) F,S.* (See Sociology)

PS 415 Administration of Justice. *Preqs: PS 311 and junior standing. Credit will not be given for both PS 415 and PA 515. 3(3 0) F.* Politics and administration in the American system of justice.

PS 431 International Law and Organization. *3(3-0) S.* The nature, development and function of international law and international organization as applied to international conflict and cooperation. Special emphasis on the United Nations as both a legal and a political instrument.

PS 437 National Security Policy. *Preq: PS 331. 3(3-0).* An examination of the formulation and implementation of contemporary United States national security policy. Emphasis is on defense policy, and attention is also given to economic issues.

DORFF, GILBERT

PS 440 Political Scandals and Corruption. *Preq: Six hours of political science. 3(3-0) S.* Comparative study of political scandals and corruption. Theories of causes, cultural variables, patterns of exposure, and political consequences of scandal and corruption in states throughout the world.

KEBSCHULL

PS 441 Military Coups & Regimes in the Third World. *Preq: Six hours of political science. Credit will not be given for both PS 441 and PS 541. 3(3 0) F.* The seizure and exercise of political power by military forces in Asia, Africa, and Latin America. Causes and techniques of military coups with emphasis on the social, economic and political policies of military regimes. Case studies within the context of theories about the political role of the military.

KEBSCHULL

PS 442 Western European Politics. *Preq: Six hours of political science. Credit will not be given for both PS 442 and PS 542. 3(3 0) S.* Political institutions and processes in selected Western European states and in the European Community. Major social, economic and political issues confronting European societies.

KEBSCHULL

PS 445 Comparative Systems of Law and Justice. *Preqs: PS 311 and junior standing. Credit will not be given for both PS 445 and PS 545. 3(3 0) F,S.* Legal culture and administration of justice in various countries and in the U.S. Emphasis on the impact of legal ideology on crime, political justice, police administration, corrections and judicial process.

MOOG

PS 446 Comparative Communist Systems. *Preq: PS 345 or 332. 3(3 0) F.* A study of the international sub-system of states ruled by the Communist Party and the international Communist movement. Focuses on the Soviet, Chinese, and Yugoslavian systems as models with emphasis placed on the institutional, political, and ideological similarities and differences within the Communist world.

MASTRO

PS 462 Seminar in Political Theory. *Preq: PS 361 or consent of instructor. 3(3-0) S.* A special area in political theory through selected texts, independent research, and seminar reports. Topics vary from year to year, such as ancient and modern political thought, democratic theory, and political theory in literature.

KESSLER

PS 471 Public Opinion Research Methodology. *3(3 0) F,S.* Survey research methodology in public opinion polling, campaign management, media and market research, needs assessment and program evaluation. Topics include questionnaire design, survey sampling, computer applications, and data analysis.

VASU

PS 474 Microcomputer Applications in Political Science. *Preq: PS 371 or CS 200 or equivalent. 3(3 0) S.* Microcomputer applications in Political Science. CARSON

PS 490 Readings and Research in Political Science. *Preq: Consent of department. 1-6 F.S.* Extensive readings and research in political science under direct faculty supervision.

PS 491 Internship in Political Science. *Preq: Consent of instructor. 1-6 F.S.* Internship in a governmental agency, interest group, or like organization involves seminar or formal report. McCLAIN

PS 492 Honors Readings and Thesis in Political Science. *Preq: Admission to Honors Program and CI. Enrollment limited to Political Science honors majors. 3-6 F.S.* Sum. Independent reading and preparation of an honors thesis in political science.

PS 498 Special Topics in Political Science. *Preq: Six hours PS. 3-6 F.S.* Detailed investigation of a topic. Topic and mode of study determined by the student and a faculty member.

Selected 500-Level Courses Open To Advanced Undergraduates

PS 502 The Legislative Process. *Preq: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3 0) S.*

PS 506 American Constitutional Theory. *Preq: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3 0) F.*

PS 507 Constitutional Theory II. *Preq: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.*

PS 514 Public Finance. *Preq: EB 205. 3(3 0) F.*

PS 531 International Law. *Preq: Grad. or advanced undergrad. standing. 3(3 0).*

PS 571 Research Methods and Analysis. *Preqs: Advanced undergrad. standing including 12 hrs. of political science, grad. standing or PBS status. 3(3-0).*

PS 598 Special Topics in Political Science. *Preq: 6 hours of political science. 1-6 F.S.*

PSYCHOLOGY

PSY 200 Introduction to Psychology. *3(3 0) F.S.* Sum. Survey of basic principles for the understanding of behavior and experience including development, learning, cognition, biological foundations, perception, motivation, personality, behavior abnormalities, measurement of individual differences, and social processes. The value of scientific observation and experimentation to the development of psychological understanding is emphasized.

CUNNINGHAM, KALAT, LUGINBUHL, MERSHON, NACOSTE, POND

PSY 210 Applied Psychology. *Preqs: PSY 200. Juniors and Seniors are advised to take PSY 412, rather than PSY 210. 3(3 0) S.* Areas of practical application of psychology. Specific content may vary from semester to semester. Typically includes illustrative cases of psychological practice in mental health, environmental design, marketing, crime control, education and work settings. SMITH

PSY (ST) 240 Introduction to Behavioral Research I. *Preq: PSY 200; Coreq: PSY (ST) 241. For PSY and HRD majors only. 3(3 0) F.S.* Introduction to quantitative methods in psychology, including measurement, experimental control, validity, and fundamentals of research design. Discussion of distributions and statistical inference. KLEIN, LEVERE

PSY (ST) 241 Introduction to Behavioral Research I Lab. *Preq: PSY 200; Coreq: PSY (ST) 240. For PSY and HRD majors only. 1(0-2) F.S.* Students design, analyze and report a variety of simple experiments. KLEIN, LEVERE

PSY (ST) 242 Introduction to Behavioral Research II. *Preq: PSY (ST) 240; Coreq: PSY (ST) 243. For PSY and HRD majors only. 3(3 0) F.S.* Continuation of PSY (ST) 240. Ethics of Research in Psychology. Techniques for the development of research proposals.

Statistical techniques for data analysis including non-parametrics, one-way and two way ANOVA and introduction to correlation and regression.
KLEIN, LEVERE

PSY (ST) 243 Introduction to Behavioral Research II Lab. *Preq: PSY (ST) 240; Coreq: PSY (ST) 242. For PSY and HRD majors only. 2(0 4) F,S.* Design and analysis of a major research project.
KLEIN, LEVERE

PSY 300 Perception. *Preqs: PSY 200. 3(3 0) F,S,Sum.* An introduction to anatomy and physiology of major sensory systems, their relation to central structures, and basic problems dealt with by psychophysics. Examination of the chief determiners of perception, including both stimulus variables and such organismic variables as learning, motivation and attention. The discussion of perceptual theory and processes emphasizes topics in two- and three-dimensional spatial perception.
MERSHON

PSY 304 Educational Psychology. *3(3-0) F,S,Sum.* Psychological principles applied to education, including cognitive and personality development, individual differences, learning and behavior theory, cognitive strategies for learning and remembering, critical thinking and problem-solving strategies, student motivation, classroom management techniques, components of teacher effectiveness, measurement and student evaluation procedures, characteristics of exceptional children, mainstreaming the classroom, and multicultural education.
HASKETT, HESS

PSY 307 Industrial and Organizational Psychology. *Preq: PSY 200, juniors and seniors. 3(3 0) S, Sum.* Surveys the application of psychological theories and methods to problems involving people in work settings. Topics include: organizational and management theory; work motivation and job satisfaction; job and organizational analysis; performance evaluation; personnel recruitment, selection, and placement; and personnel training and development.
CUNNINGHAM

PSY 310 Learning and Motivation. *Preq: PSY 200. 3(3 0) F,S,Sum.* Introduction to the primary laboratory research areas in learning and motivation: classical conditioning, operant conditioning, verbal learning, drive theory, and the role of motives. Emphasis upon research on conditioning and its motivational processes as the foundations for techniques in behavior modification. Examination of both the uses and limitations of current information on learning and motivation.
COLE

PSY 320 Cognitive Processes. *Preq: PSY 200. 3(3-0) F,S,Sum.* An introduction to research and theory in cognition including such topics as memory, acquisition and use of language, reading, problem solving, reasoning, and the acquisition and use of concepts.
NEWMAN

PSY 330 Biological Psychology. *Preq: PSY 200. BS 100 or 105 is recommended. 3(3-0) F.* Biological mechanisms of behavior, including elementary neuroanatomy and neurophysiology, sensory and motor processes, and their application to motivation, learning, and psychological processes.
KALAT

PSY 340 Ergonomics. *Preq: PSY 200. 3(3 0) F.* Concepts from ergonomics, environmental psychology, and cognitive psychology related through design examples to problems of everyday living. Criteria of efficiency, comfort and safety evaluated relative to the design of activity, products, and the environment. Topics include: visual and auditory perception, information processing, physical activity, noise and lighting, work space design, workload, and product design.
CONVERSE

PSY 350 Human Resource Development Skills. *Preq: Junior standing; Coreq: PSY 495, SP 112. For HRD majors only. 3(3 0) F.* Instruction, practice and development of skills in the psychology of behavior observation, interviewing, instruction and organizing. Emphasis on issues relevant to human service providers in public and private settings.

PSY 370 Personality. *Preq: PSY 200. 3(3 0) F,Sum.* Major personality theories. Definition of personality associated with each theory as well as the assumptions and principles used in accounting for human behavior. Theories evaluated considering recent research.

PSY 376 Developmental Psychology. *Prq: PSY 200 or 304. 3(3-0) F,S,Sum.* Behavioral development during the life span, including study of current theories and project work with persons at various stages of the life cycle.

BAKER-WARD, HALBERSTADT, SNYDER

PSY 411 Social Psychology. *Prq: PSY 200. 3(3-0) F,S.* Basic theory and research on how the average person responds to social stimuli, and how these responses are perceived and responded to by others. Topics include affiliation, attraction, interpersonal perception, altruism, aggression, attitude formation and change, conformity, group dynamics, and environmental psychology.

LUGINBUHL, NACOSTE

PSY 412 Applied Psychological Research. *Prqs: PSY 200; STA 311 or both PSY 240 and 242. 3(3-0) F.* Guided practice in applied research for students in psychology and related disciplines. Problem definition, research design, measurement, statistical analysis, and computer processing.

SMITH

PSY (PHI) 425 Introduction to Cognitive Science. *Prq: One upper level course in either PHI, PSY, CSC or Linguistics, or permission of instructor. Credit cannot be given for both PHI PSY 425 and PHI PSY 525. 3(3-0) F.* Philosophical foundations and empirical fundamentals of cognitive science, an interdisciplinary approach to human cognition. Topics include: the computational model of mind, mental representation, cognitive architecture, the acquisition and use of language.

PSY 436 Introduction to Psychological Measurement. *Prqs: PSY 240 sequence or ST 311. 3(3-0) S, Alt. yrs.* Emphasizes measurement in the science of psychology, controlled experiments, and studies of individual differences. Principles relating to applied problems are discussed, but more emphasis is placed on principles which relate to psychology as a science.

WESTBROOK

PSY 470 Abnormal Psychology. *Prq: PSY 200 or 304. 3(3-0) S,Sum.* Common psychological disorders of children and adults. Historical and theoretical perspectives on abnormal behavior; issues of assessment and classification, etiology, symptoms, and treatment of disorders.

ERCHUL, WALKER

PSY 475 Child Psychology. *Prq: PSY 200 or 304; PSY 376. 3(3-0) F,Sum.* Intellectual, social, emotional and personality development of the child. Physical growth discussed as needed for an understanding of the psychological development of the child.

BAKER WARD, HESS, WALKER

PSY 476 Psychology of Adolescent Development. *Prq: PSY 200 or PSY 304. 3(3-0) F,S,Sum.* Theories, principles, and issues related to human psychological development and emphasizing the period of adolescence. Consideration of cognitive, social, and physiological changes: their interaction; and implications for the teaching and parenting of adolescents.

SNYDER

PSY 491 Special Topics in Psychology. *Prq: PSY 200. 3(3-0) F,S.* Exploration in depth of advanced areas and topics of current interest in psychology.

PSY 495 Human Resource Development Practicum. *Prq: Jr. standing. For HRD majors only. 3 8 F,S.* Field experience in the use of skills acquired during the skill semester. The student will work at an off-campus site during two consecutive semesters.

GRAY

PSY 498 Psychology Honors Seminar. *Prq: Permission of department; HRD and PSY honors students. Must take two semesters. 3(1 4) As needed.* Seminar and independent study under faculty direction. Provides the undergraduate psychology honors students with an opportunity to practice skills in designing, conducting, and evaluating research. The student, working closely with a faculty advisor, designs a research approach to a particular body of literature, accumulates appropriate data, and analyzes and evaluates the data.

PSY 499 Individual Study in Psychology. *Prq: Permission of the Department; Coreq: PSY 495 for HRD majors during their work semester. 1-6 F,S.* Individual research project (literature review, experiment, survey, field study) open to any undergraduate, under the direction of a Psychology Department faculty member.

Selected 500-Level Courses Open To Advanced Undergraduates

- PSY 502 Physiological Psychology.** *Preq: Twelve hours of PSY including PSY 200, 300, 310. 3(3 0) F.*
- PSY 504 Advanced Educational Psychology.** *Preq: Six hours of PSY. 3(3 0) F.*
- PSY 505 History and Systems of Psychology.** *Preqs: PSY 200, 300, 310, 320 or CI or grad. status. 3(3-0) S.*
- PSY 530 Advanced Abnormal Psychology.** *Preqs: PSY 200, 370. 3(3 0) S.*
- PSY 533 Biological Factors in Abnormal Behavior.** *Preqs: Six hours of PSY and 6 hours of biology. 3(3 0) Alt. Sum.*
- PSY 535 Tests and Measurements.** *Preq: Six hours of PSY. 3(3-0) F,S,Sum.*
- PSY (IE) 540 Human Factors in Systems Design.** *Preq: IE (PSY) 338 or IE 354; Coreq: ST 507 or 515. 3(3 0).*
- PSY 565 Organizational Psychology.** *Preq: Nine hours of PSY. 3(3 0) F.*
- PSY 576 Advanced Developmental Psychology.** *Preq: Nine hours of PSY, including PSY 376, PSY 475 or PSY 476. 3(3 0).*
- PSY 577 Adolescent Development.** *Preq: Six hours of PSY or CI. 3(3 0).*
- PSY 591 Special Topics in Psychology.** *Preq: Six hours of PSY; Coreq: Three hours of ST. 1 3 F,S.*
- PSY 594 Area Seminar in Human Resources Development.** *Preq: CI. 1 3, Maj. 6. F,S.*

PHYSICS

- PY 101 Perspectives on Physics.** *Preq: Course available for Physics majors only. 1(1 0) F.* Orientation to the current practice of physics, including discussion of historical background, scientific viewpoint, current topics, and careers in physics. Visits to departmental research laboratories. **PAESLER**
- PY 201 University Physics I.** *Preq: MA 141; Coreq: MA 241. 4(3-3) S.* First course of three semester sequence for students majoring in physical and mathematical sciences. Calculus is used throughout. Principles of classical Newtonian mechanics are covered in detail.
- PY 202 University Physics II.** *Preqs: PY 201, MA 241. 4(3-3) F.* Second course of three semester sequence designed primarily for students majoring in physical and mathematical sciences. Calculus is used throughout. Principles of electricity and magnetism are covered in detail.
- PY 203 University Physics III.** *Preqs: PY 202, MA 242. 4(3 3) S.* Third course of three semester sequence designed primarily for students majoring in physical and mathematical sciences. Calculus is used throughout. Principles of wave optics and modern physics are covered in detail.
- PY 204 General Physics.** *Preq: MA 141. Credit cannot be earned for both PY 204 and PY 205. 3(3-0).* Introduction to physics, including the study of mechanics, sound, heat, and thermodynamics. The analytical approach is employed with emphasis on problem solving. Identical to PY 205, except that there is no laboratory. Offered only through Independent Studies.
- PY 205 Physics for Engineers and Scientists I.** *Preq: MA 141 with a grade of C+ or better. 4(3-3) F,S,Sum.* First semester of a two-semester sequence in introductory physics, with laboratory. A calculus-based study of mechanics, sound, and heat.
- PY 206 General Physics Laboratory.** *Preq: PY 204. Enrollment subject to approval of Physics Department, and limited to students who have passed PY 204. Not open to students having credit for PY 205. 1(0-2) F,S,Sum.* Laboratory part of PY 205. Approximately ten experiments taken from the fields of mechanics, sound, heat and thermodynamics.

PY 207 General Physics. *Preq: PY 205 or PY 204. Credit cannot be earned for both PY 207 and PY 208.* Introduction to physics, including the study of electricity and magnetism optics, and modern physics. The analytical approach is employed, with emphasis on problem solving. Identical to PY 208, except that there is no laboratory. Offered only through Independent Studies.

PY 208 Physics for Engineers and Scientists II. *Preqs: PY 205 and MA 241 with grade of C or better. 4(3-3) F.S.Sum.* Second semester of a two-semester sequence in introductory physics, with laboratory. A calculus-based study of electricity, magnetism, optics, and modern physics.

PY 209 General Physics Laboratory. *Preq: PY 207. Open only to students who have passed PY 207. Not open to students who have credit for PY 208. Enrollment subject to approval of Physics Department.* Approximately 10 experiments taken from the field of electricity and magnetism, optics, and modern physics.

PY 211 College Physics I. *(Non Calculus) Preq: MA 111 or 116. Credit not allowed for both 211 and either 201 or 205. 4(3-2) F.S.Sum.* First semester of a two semester introductory sequence in non calculus physics, with laboratory. Mechanics, heat, wave motion and sound.

PY 212 College Physics II. *(Non Calculus) Preq: PY 211; Credit not allowed for both 212 and either 202 or 208. 4(3-2) F.S.* Second semester of a two semester introductory sequence in non-calculus physics, with laboratory. Electricity, and magnetism, light, modern physics.

PY 223 Astronomy. *3(3-0) F.S.Sum.* An introductory, descriptive survey of the field of astronomy, designed primarily for the non-science major. History of astronomy; the solar system, with current results from space probes; the sun and other stars, galaxies; and cosmology. Exotic recent discoveries such as quasars, pulsars, and black holes included. A companion laboratory course (PY 225) offers an introduction to astronomical observing.

PY 225 Astronomy Laboratory. *Coreq: PY 223. 1(0-2) F.S.* Introduction to astronomical observing. Twelve exercises include astronomical instruments; the nature of light; Kepler's and Newton's laws of motion; the constellations; planets, binary stars, stellar clusters, and galaxies. Use of small telescopes to observe celestial objects.

PY 228 Introduction to Stellar Astrophysics. *Preq: PY 202 or PY 208. 3(3-0) S.* Introduction to the study of stars, galaxies, and the universe. Stars and stellar evolution; interstellar medium; galaxies and galaxy cluster; cosmology. Recent developments in the understanding of neutron stars, black holes, active galaxies, quasars, and inflationary cosmologies.

PY 231 Physics for Non-Scientists. *For humanities and social science students only. 4(3-2) F.S.Sum.* The history, philosophy, methods and fundamental concepts of physics with applications to everyday modern living. Topics in mechanics, heat, electricity, light, relativity, quantum concepts, and atomic and nuclear phenomena.

PY 240 Exophysics. *Preq: One of PY 201, 205, 211, 223. 3(3-0) F.* A wide range of principles of physics is employed to examine problems in exophysics. Topics include conditions for life on other planets, possibility of extraterrestrial intelligence and the problems of interstellar communications.

PY 299 Special Problems in Physics. *Preq: Consent of department. 1-3. F.S.* Study in experimental or analytical topics in classical and modern physics.

PY 401, 402 Quantum Physics I, II. *Preq: PY 411. 3(3-0) F.S.* An introduction to the basic principles of quantum physics with an emphasis on selected applications to atoms, molecules, solids, nuclei, and elementary particles.

PY 407 Introduction to Modern Physics. *Preqs: MA 242, PY 208. 3(3-0) F.S.* Major developments in modern physics: special relativity, origin of the quantum theory, atomic and molecular structure, structure of solids, properties of nuclei and elementary particles.

PY 411 Mechanics I. *Preqs: PY 203 or 208, MA 341. 3(3-0) F.* First semester of a two semester sequence in intermediate classical mechanics of particles and systems of particles. Solutions of problems in Newtonian mechanics; one dimensional motion; linear, damped, driven oscillations; two particle collisions; introduction to Lagrangian and Hamiltonian dynamics.

PY 412 Mechanics II. *Preq: PY 411. 3(3-0) S.* Continuation of PY 411 with emphasis on Lagrangian techniques: central force motion, rotating coordinate systems, rigid body dynamics, coupled oscillations. Elements of special relativity.

PY 413 Thermal Physics. *Preqs: PY 203 or 407, MA 341. 3(3 0) S.* An introduction to statistical mechanics and thermodynamics. The statistical study of physical systems emphasizing the connection between the statistical description of macroscopic systems and classical thermodynamics. Concepts of heat, internal energy, temperature and entropy. Classical and quantum statistical distributions.

PY 414 Electromagnetism I. *Preqs: PY 203 or 208, MA 341. 3(3 0) F.* The first semester of a two semester sequence. An intermediate course in electromagnetic theory using the methods of vector calculus. Electrostatic field and potential, dielectrics, solution to Laplace's and Poisson's equations, magnetic fields of steady currents.

PY 415 Electromagnetism II. *Preq: PY 414. 3(3 0) S.* A continuation of PY 414. Electromagnetic induction, magnetic fields in matter, Maxwell's equations, wave guides, radiation.

PY 441 Spacetime Physics. *Preq: PY 203 or 407. 3(3-0) S.* Introduction to spacetime physics in accordance with Einstein's special theory of relativity: time dilation, twin paradox, Doppler effect, relativistic space travel, four-vectors, relativistic momentum and energy conservation laws in high energy physics. Consequences of Einstein's gravitational theory in cosmology: models of the expanding universe, neutron stars, black holes and the "big bang" hypothesis.

PY 451 Electronics for Physicists. *Preq: PY 414; Coreq: PY 415. 3(1 4) S.* Analog and digital electronics laboratory course serving as an introduction to the use of modern instrumentation required for experimental research in physics. Bipolar and field effect transistors, operational amplifiers, oscillators, power supplies, analog digital and digital-analog conversion, and digital logic circuits.

PY 452 Advanced Physics Laboratory. *Preqs: Senior standing and consent of department. 1-2 F,S.* Experiments in mechanics; electromagnetism; optics; and atomic, nuclear, plasma, and solid state physics. GOULD

PY 499 Independent Research in Physics. *Preq: Consent of department. 1 6 F,S,Sum.* Study and research in physics. Topics for experimental or theoretical investigation.

Selected 500-Level Courses Open To Advanced Undergraduates

PY 506 Nuclear and Subatomic Physics. *Preqs: PY 203 or 407; PY 412. 3(3-0) F.*

PY 507 Elementary Particle Physics. *Preq: PY 401, 506. 3(3-0) S.*

PY 508 Ion and Electron Physics. *Preq: PY 414. 3(3-0) F.*

PY 509 Plasma Physics. *Preq: PY 414. 3(3 0) F.*

PY 510 Nuclear Physics II. *Preq: PY 410. 4(3 2) S.*

PY (NE) 511 Nuclear Physics for Engineers. *Preq: PY 410. 3(3 0) F.*

PY 516 Physical Optics. *Preq: PY 415. 3(3 0) F.*

PY 517 Atomic and Molecular Physics. *Preqs: PY 401, 412. 3(3 0) S.*

PY 521 Statistical Physics I. *Preqs: PY 401, PY 413. 3(3 0) S.*

PY 525 Computational Physics. *Preq: PY 411, 414. 3(3-0) F.*

PY 543 Astrophysics. *Preqs: PY 203 or 407; PY 411. 3(3 0) S.*

- PY (ECE) 552 Introduction to the Structure of Solids.** *Preq: PY 401. 3(3 0) S.*
- PY 553 Introduction to the Structure of Solids II.** *Preq: PY 552 or equivalent. 3(3 0) F.*
- PY (MA) 555 Mathematical Introduction to Celestial Mechanics.** *Preq: MA 341. 3(3 0) F.*
- PY (MA) 556 Orbital Mechanics.** *Preqs: MA 341, 405, knowledge of elementary mechanics and computer programming. 3(3 0) S.*
- PY 590 Special Topics in Physics.** *Preq: Consent of department. Credits arranged. F,S.*

RELIGION

(Also see PHI Philosophy)

REL (FLH) 101 Elementary Biblical Hebrew I. *3(3-0).* The elements of grammar and syntax essential for a reading knowledge of Biblical Hebrew. Reading is drawn primarily from the Book of Genesis and some attention given to exegetical method.

REL (FLH) 102 Elementary Biblical Hebrew II. *Preq: REL (FLH) 101. 3(3 0).* A continuation of REL (FLH) 101 with increased emphasis upon reading selected prose passages.

REL (FLH) 201 Intermediate Biblical Hebrew I. *Preq: REL (FLH) 102. 3(3-0).* Continuing development of vocabulary and understanding of grammar and syntax through reading of selected prose and poetic passages in the Hebrew Bible. Exegetical matters are considered.

REL (FLH) 202 Intermediate Biblical Hebrew II. *Preq: REL (FLH) 201. 3(3 0).* Exclusive attention devoted to reading and interpreting selected prose and poetic passages in the Hebrew Bible.

REL 298 Special Topics in Religion. *3(3 0).* Selected studies in religion that do not appear regularly in the curriculum. Topics will be announced for each semester in which the course is offered.

REL 300 Religious Traditions of the World. *3(3 0).* Major Eastern and Western religious traditions with attention to their basic teachings and practices as well as to the historical, geographical, social, and political settings in which they have arisen and developed.

REL (SOC) 309 Religion and Society. *3(3 0).* (See Sociology)

REL 311 Introduction to the Old Testament. *3(3 0).* Study of Old Testament books, examining their content, background, and development. Comparisons of the biblical material with other Ancient Near Eastern literature. Assessment of contributions from archeology and literary studies to clarifying the text.

REL 312 Introduction to the New Testament. *3(3-0).* Literary and historical study of the New Testament in its Jewish and Greco-Roman contexts. Special attention to distinctive characteristics of the Gospels and their relationships, early controversies with Judaism and the emergence of church structure and teaching.

REL 314 Introduction to Intertestamental Literature. *3(3-0).* Intertestamental literature in the context of Jewish history, institutions, and beliefs of the Intertestamental Period (ca. 300 B.C. ca. 100 A.D.).

REL 317 Christianity. *3(3 0).* Development of Christianity from its origins to the present: events, persons, ideas, beliefs, and practices which were most significant in this development.

REL (HI) 320 Religion in American History. *Preq: 3 hours of History or Sophomore standing. 3(3 0).* Representative people, movements, and thought in the major religions within the context of American society and culture.

REL 323 Religious Cults, Sects, and Minority Faiths in America. 3(3-0). Religious cults, sects, and minority faiths in America, including Mormonism, Christian Science, and Jehovah's Witnesses. Also covers such alternate groups as the holiness charismatic movement and the Unification Church. Origins, development, and teachings of these groups within the context of American culture and religion.

REL (HI) 324 American Religion After Darwin. 3(3-0). Major religious issues in America from the Civil War to the mid-1920s, including science and religion, the impact of Darwin's evolutionary theory, biblical criticism, liberalism versus fundamentalism, the churches in an industrial society.

REL 326 The Catholic Traditions. 3(3 0). The history, basic teaching, and cultural influences of Roman Catholicism and Eastern Orthodoxy.

REL 327 Issues in Contemporary Religion. 3(3-0). Responses of contemporary Western religious thinkers to critics of religion and to challenges posed by the 20th century including the Nazi Holocaust, social injustice (liberation theologies black, feminist, Third World), ecological crisis, threat of nuclear warfare, and conflicts between religions.

REL 331 The Hindu Tradition. 3(3-0). Basic religio-philosophical concepts, social institutions, and individual practices of Hindu civilization from earliest Vedic times to the present. Focus on major traditions: Action (karma), Knowledge (jnana), and Devotion (bhakti), with emphasis on disciplines (yoga), myth, symbol, art.

REL 332 The Buddhist Traditions. 3(3 0). History and structure of the Buddhist tradition analyzed through the "three jewels": the Buddha, the Monastic Community (sangha), and the Teachings (dharma). Emphasis on fundamental religio-philosophical concepts, social history and ritual practices of Southern Buddhism, early Mahayana development, and Tantric ideals. Growth of the traditions in China and Japan.

REL (HI) 407 Islamic History to 1798. *Preq: 3 hours of history.* 3(3 0). *Credit will not be given for both HI 407 and HI 507.* (See History)

REL (HI) 408 Islam in the Modern World. *Preq: 3 hours of history.* 3(3-0). (See History)

REL 498 Special Topics in Religion. *Preq: 6 hours REL. 1-6.* Detailed investigation of selected topics in religion. Topics determined by faculty members in consultation with head of the department. Course may be used for individualized study programs.

SOCIOLOGY

(Also see ANT - Anthropology)

SOC 202 Principles of Sociology. 3(3 0) *F,S,Sum.* Introduction to sociology. Analyses of key processes and institutions including interaction, inequality, organization, socialization, and social change. Includes core sociological concepts, methods, theories.

SOC 203 Current Social Problems. 3(3 0) *F,S,Sum.* Definition and substance of social problems with emphasis on contemporary United States. Problems may include crime, race conflict, illness, family stress, inequality, poverty, housing, population, and social aspects of environmental crises. Includes core sociological concepts, methods, theories.

SOC 204 Sociology of Family. 3(3-0) *F,S,Sum.* Contemporary American family structures and processes and their development. Focus on socialization, mate selection, marital adjustment and dissolution. Includes core sociological concepts, methods, theories.

SOC 205 Work: Occupations and Professions. 3(3 0) *F,S,Sum.* Focuses on worker experience of rewards, satisfaction, exploitation, and alienation. Examines occupations and work settings of industrial workers, professional workers, office workers, and executive workers. Recurrent themes include effects of technology and managerial control on worker experiences, changing job opportunities for women, and relationship of education to jobs. Includes core sociological concepts, methods, theories.

SOC 206 Social Deviance. *3(3-0) F,S,Sum.* Social processes in the creation and maintenance of deviant populations: classification, objectification of social meanings, functions of subcultures, and social outcomes of the deviance-ascription process. Includes core sociological concepts, methods, theories.

SOC 220 Cultural Geography. *3(3-0).* Investigates the world's past and present cultural diversity by studying spatial patterns of population, language, religion, material and non-material culture, technology and livelihoods, communities and settlements, and political organization and interaction.

SOC 241 Sociology of Agriculture and Rural Society. *3(3-0) F,S.* Application of sociological concepts, methods, theories and styles of reasoning to major social problems facing rural America. Changing structure of agriculture; social impact of agricultural technology; rural community growth and decline; rural industrialization, rural poverty, natural resources and environmental issues in rural America. Includes core sociological concepts, methods, theories.

SOC (ANT) 261 Technology in Society and Culture. *3(3-0) F,S.* Processes of social and cultural change with focus on role of technological innovation. Cross-cultural emphasis. Special attention to role of scientists and engineers in sociocultural change. Social and cultural impact analysis of planned technological change. Topical case studies apply course concepts and principles. Includes core sociological concepts, methods, theories.

SOC 281 Sociology of Medicine (Formerly SOC 313). *3(3-0) F,S.* Employs theory and empirical studies to understand the social etiology of disease, health practices, practitioners, and institutions, and the special area of mental health. Studies historical as well as contemporary examples of social influences on, and effects of, health throughout the world, but especially in the United States. Includes core sociological concepts, methods, theories.

SOC 300 Social Research Methods. *Preq: 3 cr. in SOC, 200 level; Coreq: ST 311, 4(3-2). F,S,Sum.* Basic methods of social research, research design, sampling, data collection, measurement, and analysis; the relationship between theory and research. Laboratory exercises on computer applications.

SOC 301 Human Behavior. *Preq: 3 cr. in SOC, 200 level. 3(3-0) F,S,Sum.* The development of personality as a consequence of social interactions and behavior of individuals in social contexts. Topics include processes of learning, socialization, social perception, organization, stability and change of attitudes, norms, norm formation and conformity, social roles and role strain, interpersonal attraction, and intergroup and intragroup relations.

SOC 302 Mass Communications and Modern Society. *Preq: 3 cr. in SOC, 200 level. 3(3-0).* Sociology of mass communications: its processes, messages, audiences, communicators, and social effects. Classic works by social scientists studied for impact of mass communications on contemporary decision-making and life style.

SOC 304 Women and Men in Society. *Preq: 3 cr. in SOC, 200 level. 3(3-0) F,S.* Investigates perpetuation and change in female and male gender roles using sociological concepts, theories and research. Explores how gender role expectations are developed and transmitted. Employs historical and cross-cultural perspectives as comparative bases for studying causes and consequences of sex differentiation in contemporary society.

SOC 305 Racial and Ethnic Relations. *Preq: 3 cr. in SOC, 200 level. 3(3-0) F,S,Sum.* Study of the nature of the relationships among racial and ethnic groups in societies around the world but with emphasis on the United States. Explores topics such as inequalities of wealth, power and status, racism, conflict, and social boundaries among groups. Current trends in intergroup relations are discussed.

SOC 306 Criminology. *Preq: 3 cr. in SOC, 200 level. 3(3-0) F,S,Sum.* The processes whereby behavior is defined as crime and persons are identified as criminals. Includes a sociological investigation of agencies of law enforcement, adjudication, corrections, and prevention; patterns of criminal behavior; explanations of variations in criminality with emphasis on sociocultural and sociopsychological theories.

SOC (REL) 309 Religion and Society. *3(3-0) F.S.* Religious beliefs, practices, and organizations addressed as social phenomena. Structural functionalism, conflict, and subjectivism as theoretical orientations for understanding influences between religion and society. Relationship of religions to family, government, and economy, and to social divisions, conflict, and change.

SOC 311 Community Relationships. *Preq: 3 cr. in SOC, 200 level. 3(3-0) S.* Institutions, organizations, and agencies found in modern communities; social problems and conditions with which they deal; their interrelationships and trends toward comprehensive planning.

SOC 342 Rural Societies Around the World. *Preq: 3 cr. in SOC, 200 level. 3(3 0) S.* Sociological description, analysis and understanding of rural societies in Asia, Africa and Latin America and an overview of the process of socioeconomic development in these societies. Specific topics include sociological approaches to the study of development, land tenure, agrarian reform, the social and economic structures of peasant societies, and peasant revolt and revolution.

SOC 351 Population and Planning. *Preq: 3 cr. in SOC. 3(3 0) F.* Effects of births, deaths and migration on population size, composition, and distribution. Socioeconomic and political implications of demographic change. Impact of alternative policies on demographic processes.

SOC 400 Theories of Social Structure. *Preq: 3 cr. in SOC, 200 level. 3(3-0) F,S.* Contributions of Durkheim, Marx, Weber and others to contemporary macro level sociological theories. Origins and development of functionalist and conflict approaches. Theories of social solidarity, class structure, the state, bureaucratization, ideology. Uses of original works.

SOC 401 Theories of Social Interaction. *Preq: 3 cr. in SOC, 200 level. 3(3 0) F,S.* Contributions of Weber, Simmel, Mead, Homans and others to contemporary micro-level sociological theories. Origins and development of ethnomethodology, symbolic interaction and exchange theory. Theories of the self, social construction of reality, interpersonal conflict. Uses of original works.

SOC 402 Urban Sociology. *Preq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0).* Urban social structures emphasizing determinants and consequences of changes in urban places and life styles. Current urban problems and various approaches to urban social planning.

SOC 410 Sociology of Organizations. *Preq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0).* Applications of sociological theories to study of organizational structures and processes. Special attention to formal and informal controls, structural change, conflict and cooperation, and organizational relations with environment. Extensive use of case studies and historical investigations.

SOC (PS) 413 Criminal Justice Field Work. *Preqs: SOC 306 and PS 311, senior standing in Criminal Justice option. 4(2 8) F,S.* Supervised observation and experience in a criminal justice agency. Study of relationships between ongoing programs and relevant political and sociological theory and research. Weekly seminars, small groups, and individual conferences. Presentation of an integrative report.

SOC 414 Social Class. *Preq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3 0).* The universality of social inequality, its bases, and consequences. Relationship of social inequality to social class, life chances, life styles and social mobility. Theories and research methods pertinent to the study of social class.

SOC 415 Social Thought. *Preq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0).* Discussion and analysis of social thought in its philosophical and social science, especially sociological perspectives. Major sociological theories, their construction and evaluation, their application to specific substantive fields, and the relationship between theory and research.

SOC 418 Sociology of Education. *Prq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0).* Application of sociological theories to education, relating processes of stratification, socialization, and organization. Sociological analysis of classroom and learning. Connections of schooling with family, community, and work. Cross-cultural and U.S. research.

SOC 420 Sociology of Corrections. *Prqs: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0) S.* A variety of correctional settings studied in sociological perspective. Major topics: formal and informal organization; inmate social systems; correctional programs and their consequences, alternatives to confinement, special-purpose facilities. Focus on contemporary American prison systems with historical and cross-cultural comparisons.

SOC 425 Juvenile Delinquency. *Prq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0) S,Sum.* Nature and extent of juvenile delinquency; measurement problems; and biogenic, psychogenic and sociogenic theories of delinquency causation. Policy implications of delinquency theories for treatment and prevention. Evaluation of treatment and prevention programs.

SOC 426 The Juvenile Justice System. *Prq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0) F.* The development of the juvenile justice system; theory and practice of juvenile justice with emphasis on social control, social organization and social interaction; decision making and its consequences as demonstrated in enforcement, adjudication and corrections. Field trips to various juvenile justice agencies.

SOC 427 Sociology of Law. *Prq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0) F.* Sociological concepts, theories, and research of law as social control. Social forces behind the creation, maintenance, and application of law in American Society.

SOC 440 Social Change. *Prq: 3 cr. in SOC, 200 level; SOC 300 or equivalent methods course. 3(3-0).* Sources, processes, and consequences of social change on macro and micro levels. Applications of classical and contemporary theories to historical and modern examples of social change in international, national, regional, community, and institutional settings. Examples of empirical studies and appropriate methodologies for each level of analysis.

SOC 485 Independent Field Work in Applied Sociology. *Prq: SOC 300; Coreq: SOC 410. Senior standing in Sociology. 3-6 F,S,Sum.* Supervised observation and experience in an applied setting. Student develops and demonstrates competency in his/her major area by applying sociological knowledge to organization/agency problems.

SOC 490 Senior Seminar in Sociology. *Prqs: Senior standing and consent of department; SOC 300 or equivalent. 3(3-0).* Synthesis of knowledge, theory, and methods from earlier courses or a detailed study of a substantive or conceptual area.

SOC 492 External Learning Experience. *Prq: Sophomore standing. 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience.

SOC 493 Special Problems in Sociology. *Prq: Sophomore standing. 1-6 F,S.* A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Arrangements must be initiated by student and approved by a faculty advisor and departmental teaching coordinator.

SOC 495 Special Topics in Sociology. *1-3 F,S,Sum.* Offered as needed to present materials not normally available in regular course offerings or for new courses on a trial basis.

SOC 498 Independent Study in Sociology. *Prq: Six hours SOC above the 200 level. 1-6 F,S,Sum.* A detailed investigation of a topic in sociology. Topic and mode of study determined by the faculty member(s) in consultation with the department head.

Selected 500-Level Courses Open To Advanced Undergraduates

- SOC 501 Leadership.** *Preq: SOC 202 or equivalent. 3(3 0).*
- SOC 502 Society, Culture and Personality.** *Preq: SOC 202 or equivalent. 3(3 0).*
- SOC 505 Medical Sociology.** *Preq: Six credits in SOC. grad. standing or PBS status. 3(3 0).*
- SOC 508 Social Organization.** *Preq: SOC 400 or SOC 511. 3(3-0).*
- SOC 509 Population Problems.** *Preq: SOC 202 or equivalent. 3(3 0).*
- SOC 510 Industrial Sociology.** *Preq: SOC 202 or equivalent. 3(3 0).*
- SOC 513 Community Organization and Development.** *Preq: SOC 202 or equivalent. 3(3-0).*
- SOC 514 Developing Societies.** *Preq: Six hours SOC. ANT, grad. standing or PBS status. 3(3-0).*
- SOC 515 Deviant Behavior.** *Preq: Six hours SOC, ANT, grad. standing or PBS status. 3(3-0).*
- SOC 516 Social Control.** *Preq: Six hours SOC above 200 level. grad. standing or PBS status. 3(3-0).*
- SOC 520 Sociology of Religion.** *Preq: SOC 202 or equivalent, grad. standing or PBS status. 3(3-0).*
- SOC 523 Sociological Analysis of Agricultural Development.** *Preq: Six hours SOC or grad. standing. 3(3-0).*
- SOC 534 Sociology of U.S. Agriculture.** *Preqs: Six hours SOC or grad. standing. 3(3-0).*
- SOC 541 Social Systems and Planned Change.** *Preq: Three hours SOC. 3(3 0).*
- SOC (EC) 574 The Economics of Population.** *Preq: EC 301 or 401. 3(3 0) S.*
- SOC 590 Applied Research.** *Preq: SOC 202 or equivalent. 3(3 0).*
- SOC 591 Special Topics in Sociology.** *Preq: CI. 1-6.*

SOIL SCIENCE

SSC 200 Soil Science. *Preqs: One semester of chemistry. 4(3-3) F.* S. Fundamentals of soils including origin, composition and classification; their physical, chemical, and biological properties; significance of these properties to soil plant relationships and soil management. **KLEISS**

SSC (BAE) 323 Water Management. *Preq: Junior standing. 3(2-2) F.* Water management principles applied to agriculture: hydrologic cycle, runoff, surface and sub surface drainage, soil conservation measures to reduce erosion and sedimentation, irrigation, pond construction, open channel flow, water rights and environmental laws pertaining to water management. Emphasis on problem solving. **SNEED**

SSC (BAE) 324 Elementary Surveying. *Preq: Junior standing. 1(0 3) F.* Theory and practice of plane surveying to include measuring distances as well as record keeping differential leveling, profile leveling, topographic mapping, stadia surveying, and the use of these tools in agricultural applications.

SSC 341 Soil Fertility and Fertilizers. *Preqs: SSC 200, BS 100. 3(3-0) F.* Principles of managing plant nutrition for crop production, fertilizer materials, crop fertilization, soil fertility maintenance, and management practices for optimizing fertilizer use; soil and plant tissue testing as diagnostic tools in nutrient management. **MINER**

SSC 342 Soil Fertility Laboratory. *Coreq: SSC 341. 1(0 3) F.* Growing plants in solution and soil. Relating nutrient requirements to soil test data determined in lab. Calculating

quantities of lime and fertilizer needed and computing least cost blends. Field trips for soil sampling and visiting soil testing lab and bulk blending plants. COX

SSC 361 Role of Soils in Environmental Management. *Preq: SSC 200, 3(2-3) S. Alt. yrs.* Role of soil in the environmental consequences of land use practices; soil factors in the competition among land uses; land treatment of municipal and industrial wastes; on site disposal of domestic wastewater; erosion and sedimentation control; land use in coastal areas; soil constraints in the development of land use plans. KING

SSC 370 Alternative Agricultural Systems. *Preq: SSC 200, 3(3-0) S. Alt. yrs.* Principles and methodologies of alternative agricultural systems (e.g. organic, biodynamic, biological, ecological, permaculture) as related to soil productivity and management, nutrient sources, energy, economics, pest management, pollution and current research. Explore the feasibility of alternative systems or combinations of alternative and conventional systems as viable methods for food and fiber production. KING

SSC 452 Soil Classification. *Preq: SSC 200, 4(2-4) S.* Genesis, morphology, and classification of soils; characterization of soils according to their diagnostic properties; interpreting soil use potential; emphasis on North Carolina soils and their taxonomy; field exercise in soil mapping and site evaluation; several field trips, one overnight. KLEISS

SSC 461 Soil Physical Properties and Plant Growth. *Preq: SSC 200 or equivalent, 3(3-0) F.* Soil physical properties and their influence upon plant growth; soil solid-porosity relationships, soil water, soil temperature, soil aeration and mechanical impedance. Principles associated with management and alteration of physical properties. CASSEL

SSC (CS) 462 Soil-Crop Management Systems. *Preqs: CS 212, CS 414, SSC 342, SSC 452; senior standing, 3(2-3) S.* Unites principles of soil science and crop science with those of allied areas into realistic agronomic applications; practical studies in planning and evaluation of soil and crop management systems. FIKE, WAGGER

SSC 472 Forest Soils. *Preq: SSC 341, or FOR 303, 3(2-3) S.* Soil as a medium for tree growth; relation of soil physical, chemical, and biological factors to the practice of silviculture; extensive soil management in the forest and intensive soil management in forest nurseries and in seed orchards; relation of soil and site to forest genetics, ecology, pathology, and entomology. DAVEY

SSC 490 Senior Seminar in Crop Science and Soil Science. *Preq: Senior standing, 1(1-0) S.* Review and discussion of current topics in crop science, soil science, agronomy and natural resource management. Preparation and presentation of scientific information in written and oral format. KLEISS

SSC 492 External Learning Experience. *Preq: Sophomore standing, 1-6 F, S.* A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with the prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience. KLEISS

SSC 493 Special Problems in Soil Science. *Preq: Sophomore standing, 1-6 F, S.* A learning experience in agriculture and life sciences within a framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator and the academic dean prior to the experience. KLEISS

SSC 495 Special Topics in Soil Science. *Preq: SSC 200, 1-6 F, S.* Special topics, problems, trial courses, or activities in various phases of soil science. KLEISS

Selected 500-Level Courses Open To Advanced Undergraduates

SSC 501 Tropical Soils: Characteristics and Management. *Preq: Six credits in SSC, 3(3-0) S. Alt. yrs.*

- SSC 511 Soil Physics.** *Preqs: SSC 200, PY 212. 4(3-3) F.*
- SSC 520 Soil and Plant Analysis.** *Preqs: PY 212; CH 315; at least three soils courses including SSC 341 or CI. 3(2-3) Alt. S.*
- SSC 522 Soil Chemistry.** *Preqs: SSC 200, one year of general inorganic chemistry. 3(3-0) S.*
- SSC 532 Soil Microbiology.** *Preqs: MB 401; CH 220 or CI. 4(3-3) S.*
- SSC 541 Soil Fertility.** *Preq: SSC 341. 3(3-0) F.*
- SSC 551 Soil Morphology, Genesis and Classification.** *Preqs: MEA 120, SSC 200, SSC 341. 3(3-0) F.*
- SSC 553 Soil Mineralogy.** *Preqs: SSC 200, SSC 341, MEA 330. 3(2-3) F.*
- SSC 562 Environmental Applications of Soil Science.** *Preq: SSC 200 or CI. 3(2-3) S.*
- SSC 590 Special Problems.** *Preq: SSC 200. Credit Arranged. F,S.*

STATISTICS

ST 101 Statistics by Example. *Preq: Credit not allowed if student has prior credit for another ST course. 3(3-0) F.* Sampling, experimental design, tables and graphs, relationships among variables, probability, estimation, hypothesis testing. Real life examples from the social, physical and life sciences, the humanities, and sports. BRIGGS, DIETZ

ST (PSY) 240 Introduction to Behavioral Research I. *Preq: PSY 200; Coreq: PSY (ST) 241. For PSY and HRD majors only. 3(3-0) F,S. (See Psychology)*

ST (PSY) 241 Introduction to Behavioral Research I Lab. *Preq: PSY 200; Coreq: PSY (ST) 240. For PSY and HRD majors only. 1(0-2) F,S. (See Psychology)*

ST (PSY) 242 Introduction to Behavioral Research II. *Preq: PSY (ST) 240; Coreq: PSY (ST) 243. For PSY and HRD majors only. 3(3-0) F,S. (See Psychology)*

ST (PSY) 243 Introduction to Behavioral Research II Lab. *Preq: PSY (ST) 240; Coreq: PSY (ST) 242. For PSY and HRD majors only. 2(0-4) F,S. (See Psychology)*

ST 301 Statistical Methods I. *Preqs: MA 141, CSC 110 or CSC 112. 3(3-0) F.* Contemporary description and analysis of single samples of data. Graphical data presentation methods for determination of patterns and relationships among variables. Classical and robust alternative methods for single sample data summary procedures. Probability concepts, sampling, and expectations. Confidence interval and hypothesis testing for sample mean and proportion. Computer use emphasized.

ST 302 Statistical Methods II. *Preq: ST 301. 3(3-0) S.* Confidence intervals and hypothesis testing with graphics in multiple samples and/or variables cases: tests for means/proportions of two independent groups, analysis of variance for completely randomized design, contingency table analysis, correlation, single and multiple linear regression; design of experiments with randomized blocks, factorial design and analysis of covariance. Computer use emphasized.

ST 311 Introduction to Statistics. *Preq: Credit not allowed if student has prior credit for another ST course or BUS 350. 3(3-0) F,S,Sum.* Examining relationships between two variables using graphical techniques, simple linear regression and correlation methods. Producing data using experiment design and sampling. Elementary probability and the basic notions of statistical inference including confidence interval estimation and tests of hypothesis. One and two sample t-tests, one way analysis of variance, inference for count data and regression. GERIG

ST (BUS) 350 Economics and Business Statistics. *Preqs: MA 114; EC 201 or 212. 3(3-0) F,S,Sum. (See Business Management)*

ST 361 Introduction to Statistics for Engineers. *Preq: College algebra. 3(3-0) F,S,Sum.* Statistical techniques useful to engineers and physical scientists. Includes elementary probability, frequency distributions, sampling variation, estimation of means and standard deviations, confidence intervals, significance tests, elementary least squares curve fitting.

ST 371 Introduction to Probability and Distribution Theory. *Preq: MA 241; Coreq: MA 242. 3(3-0) F,S,Sum.* Basic concepts of probability and distribution theory for students in the physical sciences, computer science and engineering. Provides the background necessary to begin study of statistical estimation, inference, regression analysis, and analysis of variance.

ST 372 Introduction to Statistical Inference and Regression. *Preq: ST 371. 3(3-0) F,S,Sum.* Statistical inference and regression analysis including theory and applications. Point and interval estimation of population parameters. Hypothesis testing including use of t , χ^2 and F . Simple linear regression and correlation. Introduction to multiple regression and one way analysis of variance.

ST 421 Introduction to Mathematical Statistics I. *Preq: MA 242. 3(3-0) F.* Elementary mathematical statistics primarily for undergraduate majors and graduate minors in Statistics. Introduction to probability, common theoretical distributions, moments, moment generating functions, sampling distributions, central limit theorem.

ST 422 Introduction to Mathematical Statistics II. *Preq: ST 421. 3(3-0) S.* Elementary mathematical statistics primarily for undergraduate majors and graduate minors in Statistics. Point and interval estimation, maximum likelihood, tests of hypotheses, concepts of decision theory and elements of general linear model theory.

ST 430 Introduction to Regression Analysis. *Preq: ST 302. 3(3-0) F.* Regression analysis as a flexible statistical problem solving methodology. Matrix review; variable selection; prediction; multicollinearity; model diagnostics; dummy variables; logistic and non-linear regression. Emphasizes use of computer.

ST 431 Introduction to Experimental Design. *Preq: ST 302. 3(3-0) S.* Experimental design as a method for organizing analysis procedures. Completely randomized, randomized block, factorial, nested, latin squares, split-plot, and incomplete designs. Response surface and covariance adjustment procedures. Stresses use of computer.

ST 432 Introduction to Survey Sampling. *Preq: ST 302. 3(3-0) S.* Design principles pertaining to planning and execution of a sample survey. Simple random, stratified random, systematic, and one- and two-stage cluster sampling designs. Emphasis on statistical considerations in analysis of sample survey data. Class project on design and execution of an actual sample survey.

ST 435 Statistical Methods for Quality and Productivity Improvement. *Preq: ST 302. 3(3-0) F.* Use of statistics for quality control and productivity improvement. Control chart calculations and graphing, process control and specification; sampling plans; and reliability. Computer use will be stressed for performing calculations and graphing.

ST 445 Introduction to Statistical Computing and Data Management. *Preq: ST 302. 3(3-0) S.* Introduction to use of computers to manage, process and analyze data. Topics include concepts of research; data management; JCL and utility programs; use of statistical program package for data analyses and graph production; and writing statistical programs to perform simulation experiments. Students will make reports on class projects.

ST 493 Special Topics in Statistics. *Preq: Consent of department. 1-3 F,S,Sum.* In depth exploration of advanced areas and topics not covered in present statistics courses. Topics and mode of study determined by faculty member.

Selected 500-Level Courses Open To Advanced Undergraduates

ST 505 Applied Nonparametric Statistics. *Preq: ST 372 or ST 511. 3(3-0) S.*

ST (ZO) 506 Sampling Animal Populations. *Preq: ST 512. 3(3-0) F. Alt. yrs.*

- ST 507 **Statistics for the Behavioral Sciences I.** 3(3 0) F.S.
- ST 508 **Statistics for the Behavioral Sciences II.** *Preq: ST 507 or CI. 3(3-0) S.*
- ST 511 **Experimental Statistics for Biological Sciences I.** *Preq: ST 311 or grad. standing. 3(3 0) F.S.*
- ST 512 **Experimental Statistics for Biological Sciences II.** *Preq: ST 511 or equivalent. 3(3 0) F.S.*
- ST 514 **Experimental Statistics for Social Sciences II.** *Preq: ST 507 or equivalent. 3(3-0) S.*
- ST 515, 516 **Experimental Statistics for Engineers.** *Preq: (515) ST 361 or grad. standing; (516) ST 515 or equivalent. 3(3 0) F.S.*
- ST 517 **Applied Least Squares.** *Preq: ST 430 or equivalent. 3(3 0) F.*
- ST 518 **Applied Time Series Analysis.** *Preq: ST 512. 3(3-0) F.*
- ST 519 **Applied Multivariate Statistical Analysis.** *Preq: ST 512 or equivalent. 3(3 0) S.*
- ST 521 **Statistical Theory I.** *Coreqs: MA 425 or MA 511 and MA 305. 3(2-2) F.*
- ST 522 **Statistical Theory II.** *Preq: ST 521; Coreq: MA 426 or MA 512. 3(2-2) S.*
- ST 531 **Design of Experiments.** *Preq: ST 431 or equivalent. 3(3 0) F.*
- ST 535 **Statistical Quality Control.** *Preq: ST 515. 3(3 0) F.*
- ST (MA) 541 **Theory of Probability I.** *Preq: MA 425 or 511. 3(3-0) F.*
- ST (MA) 542 **Introduction to Stochastic Processes.** *Preqs: MA 305 and ST 541 or ST 521. 3(3 0) S.*
- ST (TOX) 563 **Statistical Problems in Toxicology.** *Preq: ST 511 or equivalent. 2(2 0) S. Alt. yrs.*
- ST (BMA, MA) 571 **Biomathematics I.** *Preq: Advanced calculus, reasonable background in biology or CI. 3(3-0) F.*
- ST (OR, BMA) 575 **Decision Analytic Modeling.** *Preq: MA 421 or ST 421 and ST 507 or ST 511 or ST 515. 4(3-2) F. Alt yrs.*
- ST 591 **Special Problems.** *Preq: CI. 1 3 F.S.Sum.*

SOCIAL WORK

(Also see SOC - Sociology; ANT - Anthropology)

- SW 201 **Community Social Services.** 3(3-0) F. Study of social services typical of American communities including services to children, families, and older persons; and services in mental health, criminal and juvenile justice, and industry. Volunteer work required.
- SW 203 **The Development of Social Welfare in the U.S.: Policy and Programs I.** 3(3-0) F.S. Major programs and policy developments in U.S. social welfare from the colonial period through the depression of the 1930's. Emphasis is upon definition of social problems and the characteristics of social programs.
- SW 205 **Social Welfare in Contemporary America: Policy and Programs II.** *Preq: SW 203. 3(3-0) F.S.* Social welfare policy and programs from the 1930's to the present. Social security, employment programs, public assistance, the War on Poverty, reform efforts of the 1970's and developments in the 1980's.
- SW 307 **Economic Security Programs.** *Preq: SW 205. 3(3-0) S.* Major economic security programs and their impact on the populations they serve. Analysis and evaluation of the benefit structure of social insurance and public assistance programs and proposals and attempts to reform these programs.

SW 309 Social Work in Schools. *Preq: Social work students. 3(3 0) F,Sum.* Practice models and roles relevant to school social work. Emphasis on cooperative work with school personnel in the identification, prevention and treatment of social, emotional and behavioral problems of children and interventive techniques with parents and community groups. Designed for individuals preparing for social work practice in the public schools and for school social workers toward recertification.

SW 310 Human Behavior Theory for Social Work Practice. *Sophomore standing. 3(3 0) F,S.* Theory regarding human social functioning for students intending to practice social work. Emphasis on social, biological, psychological, and cultural factors in human life.

SW 311 Black Family in its Social Environment. *Preq: Sophomore standing. 3(3 0).* Considers alternative conceptual models of Black family life and their relationships to other social institutions and to social policy development. Examines policy implications of Black family demographic characteristics, socialization patterns, gender roles, and kinship patterns.
SMITH

SW 312 Social Work Practice in Health Care. *Social Work students. 3(3 0).* Practice skills and knowledge required of social workers in health care systems. Multidisciplinary team work in health care. Social components of major illnesses and disabilities, including prevention and rehabilitation. Emotional, cultural, economic and social factors in health and illness. Health needs of specific population groups.

SW 314 Child Welfare. *Social Work students. 3(3-0).* Focuses on social work practice with children, youth, their parents and substitute parents. Emphasizes development of diagnostic and case planning activities which support, augment or substitute for the family. Includes methods of protective services which focus on the maintenance, improvement and or restoration of the social functioning of parents and children.

SW 320 Social Work Practice I. *Preq: SW 310. 3(3 0) F,S.* Elements of the general method of social work practice: professional values, client worker relationships, and professional roles. Interviewing skills and problem analysis.

SW 405 Social Work Practice II. *Preq: SW 320. 3(3-0) F,S.* Problem solving in social work practice with individuals and groups, including family and community groups.

SW 406 Field Work in Social Services I. *Preq: SW 320; Coreq: SW 405. This course may be repeated only once. 6(2-16) F,S.* Supervised placement in a social service organization. Application of social work knowledge and skill. Weekly seminar on campus.

SW 407 Field Work in Social Services II. *Preq: SW 406. This course may be repeated only once. 6(2 16) F,S.* Advanced supervised work in social service organization. Weekly seminar on campus.

SW 420 The Legal Aspects of Social Work. *Preq: SW 307; Social Work students. 3(3-0) F,S.* Legal environment of the social work profession. Relationships among legal processes, the delivery of social work services, and client problems.

SW 498 Special Topics in Social Work. *Preq: Nine hours of Social Work. Social Work students. 1 6 F,S,Sum.* Independent or small group study of a social work practice or social welfare area.

TEXTILES

T 105 Introduction to Textile Material Science. *3(2-2) F,S.* Special properties of fibers and their classification, structures of yarns and fabrics, surface treatments of fabric, end products, market and management factors. Exercises and tutorial/problem sessions. A field trip will be required.

T 110 Textiles Scholars Forum. *Preq: Enrollment limited to participants in the Textiles Scholars Program. 0(2-0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

T 200 Introduction to Textiles. *Not open to students required to take T 105. 3(3 0) S.* Survey of textiles including technical and economic history of the industry; physical and chemical processes involved in producing textile products from raw materials; unique aesthetic, physical and chemical properties of textiles and how these properties are determined by raw materials and production processes; and influence of properties of textile materials on their utilization and performance.

T 210 Textiles Scholars Forum. *Preq: Enrollment limited to participants in the Textiles Scholars Program. 0(2 0) F,S.* Interdisciplinary seminar series with presentations by distinguished faculty members and experts drawn from technical, academic, business and government communities. Discussions of major public issues and topics of contemporary concern.

T 401 Environmental Aspects of the Textile Industry. *Preq: Senior standing. 3(3 0) S.* Environmental pollution sources and effects, occupational safety and health, and typical problems specific to the textile industry. Survey of natural and synthetic fiber pollution problems with case histories. Techniques for pollution control by source reduction and treatment. Safety and health management for hazards in the industry.

T 402 Introduction to the Theory and Practice of Fiber Formation. *Preqs: Senior standing; TC 203, MA 231, PY 212, and either CH 103 or CH 107. 3(3-0) F.* Flow behavior of polymeric materials as related to the formation of fibers by melt, dry and wet extrusion. Elementary theories of drawing and heat setting. Application of fiber-forming theories to synthetic and cellulosic fibers.

T 490 Development Projects in Textiles. *Preqs: Senior standing and 2.75 GPA. Course may be taken twice provided projects are different subject matter. 2-3 F,S,Sum.* Directed undergraduate research in textile engineering and science through experimental, theoretical and literature studies in textile and related problems.

T 491H Honors Seminar in Textiles. *By invitation into Honors Program in Textiles. 1(1-0) F,S.* A seminar on current university and industrial research in the field of textiles.

T 492 Special Topics in Textiles. *Preq: Senior standing. 1-3 F, S.* Special topics related to textile engineering and science.

T 493 Industrial Internship in Textiles. *Preq: Textile core courses. (Minimum GPA 2.0). Limited to three credits per student, 10 weeks of 40 hours required. 3 F,S,Sum.* Paid professional level work experience in textiles, relating academic training in science and technology to industrial practice under professional guidance. Written reports used for grading. Appropriate department head approval required.

T 495 Senior Seminar in Textiles. *Preqs: Senior standing and CI. Restricted to students in the College of Textiles. 1(1 0) F.* Topics of current interest and case studies in the textile and allied industries are presented by guest lecturers. Written reports and discussions required of students.

T 497 Independent Research in Textile Engineering, Chemistry and Materials Science I. *Preq: Junior standing in TECS; 2.8 GPA; course coordinator's approval. 3(0 9) F,S,Sum.* Independent research in Textile Engineering, Chemistry and Materials Science topics through experimental, theoretical and literature studies. Written and oral reports required.

T 498 Independent Research in Textile Engineering, Chemistry and Materials Science II. *Preq: T 497; course coordinator's approval. 1-3 F,S,Sum.* Independent research in Textile Engineering, Chemistry and Materials Science topics through experimental, theoretical and literature studies. Written and oral reports required.

TEXTILE AND APPAREL MANAGEMENT

TAM 170 Textile Design Orientation. *1(0 2) S.* Orientation course designed to present the breadth and scope of the Textile Design profession together with future opportunities in this field.

TAM 218 Introduction to Apparel Technology Management. *Preq: T 105. 3(3 0) F, S.* Structure and organization of the apparel industry and its strategic function in the soft goods pipeline together with an analysis of the critical stages involved in the manufacture of apparel and other sewn products.

TAM (DN) 272 Printed Textile Design. *Preq: A grade of C or better in DF 101 or DF 111. 3(1-6) S.* Design and production of printed and pattern dyed fabrics. Development of design abilities through hand production methods with an awareness of industrial processes.

TAM 315 Apparel Production I. *Preq: TAM 215. 3(2 2) F.* Concepts and practices for the production of basic apparel items, beginning with selection of fabric and other raw material garment components and extending through pattern development, pattern grading, and pattern engineering. Techniques for development of styled patterns and for solution of problems of fit.

TAM 316 Apparel Production II. *Preq: TAM 315. 3(2-2) S.* Principles of apparel manufacturing; markers (stencils and computer); spreading and cutting technology; and sewing, stitching, and joining for industrial sewing machines and ultrasonic machines; pressing.

TAM 330 Textile Measurements and Quality Control. *Preqs: TS 211, TT 220, TT 250, ST 361. 4(3 2) F, S.* Principles of measuring basic physical properties of textile materials; techniques of in process control and evaluation of product quality; application to the manufacturing sequence of statistical control charts and capability limits; aspects of sampling theory.
BANKS LEE

TAM 331 Quality Control for Textile Production Management. *Preqs: TS 211, TT 220, TT 250, ST 361. Not for students who take TAM (TT) 330. 3(2-2) F, S.* Principles of quality control applied by management to the production process; techniques of decision making relative to product quality and profits; attitudes and responsibilities for quality; systems for quality assurance.
SUH

TAM (ID) 371 Woven Textile Design. *Preq: T 105. 3(1 4) F.* Design and production of woven fabrics, including an exploration of various basic structures, color effects and textural effects. Development of design abilities through hand production methods with an awareness of industrial processes.
SMITH

TAM (ID) 372 Knitted Textile Design. *Preq: T 105. 3(1-4) S.* Design and production of both hand- and machine knitted fabrics, jacquard patterning, and color effects. Development of design abilities through practical application of hand- and machine-production methods. Awareness of industrial processes.
DONALDSON

TAM 380 Management and Control of Textile and Apparel Systems. *Preqs: EC 201, TT 220, TT 250, CSC 200, or Junior standing in Textile Engineering. 3(3-0) F, S.* Management approaches and practices and basic economic considerations in the development, production, and distribution of industrial and consumer textile and apparel products.

TAM 381 Supervision in the Textile and Apparel Industries. *Preqs: TAM 380, PSY 200. 3(3 0) S.* Supervision applied to the specific problems confronting the textile and apparel industries. Role of supervisors in maintaining productivity in an atmosphere wherein continuing and critical problems prevail. Emphasis on supervisors competencies needed to effectively discharge their responsibilities.
ROBINSON

TAM 382 Principles of Soft Goods Marketing. *Preq: EC 201. Credit not allowed for both TAM 382 and BUS 360. 3(3 0) F.* Principles of marketing textiles in the consumer goods sector. Emphasis on market segmentation, product strategy, pricing decisions, promotion

and channels of distribution. Interface between textile manufacturers and those producing apparel and upholstered furniture. Marketing channel for apparel to the retailer.

BERKSTRESSER

TAM 383 Management Aspects of Textile Product Development. *Preqs: TS 211, TT 220, TT 250, TC 301. 3(3 0) S.* Development of products in order to meet profit goals. Integrates technology skills with management skills in problem solving.

BERKSTRESSER, GILMORE, LITTLE

TAM 415 Apparel Product Development. *Preq: TAM 218, 315, 316. 3(2 2) F.* Introduction to various methods of generating patterns for mass-produced apparel with emphasis on "flat pattern" design techniques. Relationship of body configuration to pattern shape, specifications to garment size and fit, standards for judging fit, distinctions between ease and style fullness, and design analysis procedures are included.

TAM 416 Apparel Production III. *Preq: TAM 218; BUS 350 or ST 361; TAM 316. 3(2-2) S.* Traditional and non-traditional workplace designs for textile and apparel production. Applications of computerized predetermined time study, work measurement, line balancing techniques as production optimization tools in labor-intensive environments. Emphasis on computer applications for simulation and management of apparel production, product data management, payroll, incentive systems.

TAM 431 Fabric Performance Testing. *Preqs: TAM (TT) 330, senior standing. 3(2-2) F.* Standard and special techniques of measurement of physical and mechanical properties of fabrics. Underlying principles of measurement techniques and effects of test conditions. Design of test and interpretation of test data in light of the end-use performance requirements.

GHOSH

TAM (DN) 470 Textile Design Studio. *Preq: A grade of C or better in TAM (DN) 272, 371, and 372. 6(0 9) F.* Semester design project based on a single problem statement. Individual investigation of resources, processes and solutions in the development of a collection of fabrics or end products. Public exhibition of collections.

DONALDSON

TAM 480 Production Management Decisions for Textile Operations. *Preqs: TAM 380, EC 301, ACC 280 or 210, senior standing. 3(2-2) F.S.* Quantitative techniques for decision making and management in a textile/apparel environment.

BERKSTRESSER, HODGE, POWELL

TAM (BUS) 482 Textile Marketing Management. *Preqs: TAM 382 or BUS 360; EC 301; Coreq: TAM 380. 3(2 2) F.* The development and state of the art of current textile marketing management theory and practice are covered in classroom sessions. Management lab sessions include experiential, marketing games, and role-playing exercises. Current industry practice and government relations are stressed.

BERKSTRESSER

TAM 484 Management Decision Making for the Textile Firm. *Preqs: TAM 480, TAM 482, and EC 302. 3(3 0) F.S.* Economic, institutional and environmental settings within which management decisions are made, including in depth analyses of specific issues and problem areas affecting the textile industry. Special emphasis on strategic management and topics of current interest and significance.

BERKSTRESSER

TAM 487 Textile and Apparel Labor Management. *Preq: Sr. standing. 3(3-0) F.* Labor management problems. Emphasis directed toward role of production supervision in textile and apparel plants. Study of NLRB decisions and court opinions involving textile and apparel corporations.

POWELL

TAM 490 Development Projects in Textile and Apparel Management. *Preq: Junior standing and 2.75 GPA. Courses may be taken twice provided projects are different subject matter. 1-3 F.S.Sum.* Directed research in Textile and Apparel Management through experimental, theoretical and literature studies in textile and apparel related problems.

TAM 491 Special Topics in Textile and Apparel Management. *Preq: Sr. standing. 1-3 F.S.* Special topics related to textile and apparel management.

TAM 495 Senior Seminar in Textile and Apparel Management. *Prq: Senior standing and consent of instructor. Restricted to students in the College of Textiles. 1(1 0) F.* Topics of current interest in the textile and allied industries are presented by guest lecturers. Written reports and discussions required of students.

TAM 499 Independent Research in Textiles and Apparel. *Prqs: Senior standing and 2.75 GPA. Course may be taken twice provided projects are different. 2 3 F,S,Sum.* Directed undergraduate research in textiles and apparel through experimental, theoretical and literature studies in related problems.

Selected 500-Level Courses Open To Advanced Undergraduates

TAM 520 Yarn Processing Dynamics. *Prqs: MA 301 and CI or grad. standing. 3(2 2) F.*

TAM 530 Textile Quality Control. *Prq: TAM (TT) 330 or CI. 3(3 0) S.*

TAM 541 Theory and Practice of Knitted Fabric Production and Control. *Prqs: TAM (TT) 370 and CI. 3(3 0) F.*

TAM 549 Warp Knit Engineering and Structural Design. *Prq: TT 443. 3(3 0) S.*

TAM 555 Production Mechanics and Properties of Woven Fabrics. *Prqs: MA 301 and CI or grad. standing. 3(2-2) S.*

TAM 561 Mechanical and Rheological Properties of Fibrous Material. *Prq: MA 301. 3(2 2) S.*

TAM 562 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures. *Prqs: MA 301, PY 208. 3(3 0) F.*

TAM 563 Characterization of Structure of Fiber Forming Polymers. *Prqs: MA 301, PY 208. 3(3-0) F.*

TAM (EB) 585 Market Research in Textiles. *Prqs: TAM (BUS) 482. 3(3 0) S.*

TAM 590 Special Projects in Textiles. *Prqs: Sr. standing or grad. standing. CI. 2 3 F,S,Sum.*

TAM 591 Special Topics. *Prq: CI. 1-4 F,S.*

TEXTILE CHEMISTRY

TC 105 Introduction to Textiles and Computers. *3(2-2) F.* Overview of the properties and uses of polymers, fibers, yarns, fabrics, dyestuffs, and textile finishes. Emphasis on computer applications in practicum. Field trip required.

TC 203 Introduction to Polymer Chemistry. *Prq: CH 101. 3(3-0) F,S,Sum.* The organic reactions and principles necessary to understand the preparation properties and chemistry of polymers are surveyed; the synthesis, applications and behavior of the common classes of polymers are discussed with emphasis on those materials used in the textile industry; the chemistry and structure of natural and man made fibers are given special attention.

TC 301 Technology of Dyeing and Finishing. *Prq: TC 203. 4(3 2) F,S,Sum.* Basic principles and procedures for the preparation, dyeing, printing, and finishing of natural and man made fibers. The chemical nature of dyes and fastness properties, and the chemical nature of finishes used to impart specific end-use properties.

TC 305 Introduction to Color Science and Its Applications. *Prq: PY 212 or PY 208. 3(2-2) S.* Basic principles and applications of color science. Physical, physiological and psychophysical aspects of color, color perception, color specification, color measurement and color control. Laboratory and computer color graphics exercises to aid understanding of color science.
McGREGOR, SMITH

TC 310 Textile Preparation and Finishing Chemistry. *Prq: TC 301. 3(3 0) F.* Topics in textile wet processing. Chemical mechanisms and unit operations in fabric preparation and finishing.

TC 320 Textile Dyeing and Printing. *Preqs:* TC 203, TC 301; *Coreq:* CH 223. 3(3-0) S. Topics in coloration of textile fibers; chemical and physical mechanisms in textile dyeing and printing.

TC 407 Wet Processing Operation and Quality Control. *Preqs:* TMS 210, TC 310, TC 320. 3(1 6) S. Pilot scale batch and continuous wet processing. Selection and use of process and quality control tests.

TC 412 Textile Chemical Analysis. *Preq:* TC 203. 3(2 3) S. Application of certain techniques of analysis to fibers, textile chemicals and textile processes; ultraviolet, visible and infrared spectrophotometry; chromatography; viscometry; interfacial tension; calorimetric, gravimetric and mechanical thermal analyses. Emphasis on solving problems of analysis involving such processes as sorption, solution, diffusion, crystallization, etc.

TC 441 Theory of Physico-Chemical Processes in Textiles I. *Preqs:* C in MA 231 or 241 and C in PY 205 or 211; *Coreq:* PY 212 or PY 208. 3(3 0) F. First semester of a two-semester sequence. Systems and processes, thermodynamics. Applications to polymer and textile wet processing situations.

TC 442 Theory of Physico-Chemical Processes in Textiles II. *Preq:* TC 441. 3(3 0) S. Second semester of a two-semester sequence. Ideal and non ideal solutions, colligative properties. Electrochemistry, dyeing isotherms, chemical kinetics, surface chemistry, theory of repellency and other special topics.

TC (CH) 461 Introduction to Fiber-Forming Polymers. *Preq:* CH 223. 4(3-3) F. Synthesis and properties of fiber-forming polymers. Step-growth and chain-growth polymerization. Survey of formation techniques for synthetic fibers. Relationships between chemical structure and physical properties of natural and synthetic fibers.

TC 466 Polymer Chemistry Laboratory. *Preq:* TC 441 or CH 431; *Senior standing.* 3(1 6). Synthesis and characterization of polymers; thermodynamics of rubber elasticity and gelation; spectroscopic, thermal and scattering techniques for polymer analysis. The processing of polymers into fibers and films.

TC 491 Seminar in Textile Chemistry. *Preqs:* TC 310, TC 320 and *senior standing.* 1(0 2) S. Familiarizes student with the principal sources of textile chemistry literature and emphasizes importance of keeping abreast of developments in the field. Emphasizes fundamentals of technical writing. Reports, lectures arranged.

TC 492 Special Topics in Textile Chemistry. *Preq:* permission of instructor. 1 3 F,S. Presentation of material not normally available in regular course offerings or offering of new courses on a trial basis. Credits and content determined by faculty member in consultation with the Department Head.

Selected 500-Level Courses Open To Advanced Undergraduates

TC 504 Fiber Formation - Theory and Practice. *Preqs:* MA 341, PY 208 or CI. 3(3-0) S.

TC 505 Theory of Dyeing. *Preq:* CH 433 or CI. 3(3-0) S.

TC 506 Color Science. *Preq:* Sr. in TC or grad. standing. 3(2-2) F.

TC 520 Chemistry of Dyes and Color. *Preqs:* CH 221 and 223. 3(3 0) S.

TC 530 The Chemistry of Textile Auxiliaries. *Preq:* One year of organic chemistry. 3(3-0) F.

TC 561 Organic Chemistry of High Polymers. *Preqs:* TC(CH) 461, CH 331 or CH 431. 3(3 0) S.

TC (CH) 562 Physical Chemistry of High Polymers - Bulk Properties. *Preqs:* CH 220 or 223, CH 331 or 431. 3(3-0) F.

TC 565 Polymer Applications and Technology. *Preq:* One year of organic chemistry; TC 461. 3(3-0) S.

TC (CHE) 569 **Polymers, Surfactants and Colloidal Materials.** *Preqs: CHE 316, CH 223, 3(3-0) F.*

TC (CHE) 570 **Radiation Chemistry and Technology of Polymeric Systems.** *Preqs: CH 221, 431, 3(3 0) S.*

TC 591 **Special Topics in Textile Science.** *Preqs: Sr. or grad. standing and CI. 1-4 F,S.*

TEXTILE ENGINEERING

TE 201 **Polymer and Fiber Science and Engineering.** *Preqs: MA 241, CH 101, 4(3-2) S.* Principles of polymer chemistry; chemical and physical properties of polymers; engineering principles of fiber formation; properties and uses of fibers.

TE 301 **Textile Manufacturing Processes and Systems I.** *Preqs: TE 201, PY 205, MA 242; Coreq: MAE 314, 4(3 2) F.* Engineering analysis of textile structures, especially yarns. Unit processes of production, handling and packaging. Production sequences, intermachine effects, machine design and their consequences on the textile product.

TE 302 **Textile Manufacturing Processes and Systems II.** *Preq: TE 301, 4(3 2) S.* Mechanisms used in the production of woven, knitted and nonwoven fabrics. Design and operation of these mechanisms and their impact on the fabric. System dynamics of the different fabric forming processes.

TE 303 **Textile Chemical Processes.** *Preqs: MAE 301, MAE 308, TE 302, 4(3-2) F.* Thermodynamic concepts of material and energy balances describing preparation, dyeing, drying, humidification and chemical reactor design for selected textile chemical wet processes.

TE 401 **Textile Engineering Design I.** *Preqs: MAE 208, MAE 314; Coreq: TE 303, 4(3-3) F.* The design process including initial specification, design constraints, sources of information and design strategy. Development of fact finding ability in areas unfamiliar to the student. Analysis of existing designs and the development of improved or new designs.

TE 402 **Textile Engineering Design II.** *Preq: TE 401, 4(2-6) S.* Application of engineering and textile science to the design of textile machines and processes. Design, construction, and evaluation of a modular component of a selected machine.

TE 403 **Mechanics of Fibrous Structures.** *Preqs: MAE 314, 3(3 0) F.* Mechanics of fibrous structures including fibers, yarns and fabrics. Transverse isotropy of fibers; tensile, bending, and shear behavior of fabrics.

TE 404 **Textile Process Quality Control.** *Preqs: ST 361; TE 302; ECE 331, 4(3 2) S.* Defining and quantifying quality of textile products; quality control by statistical sampling and continuous monitoring. Design of continuous monitoring and control systems; applications to textile systems design.

TE 492 **Special Topics in Textile Engineering.** *Preq: Permission of instructor, 1-3 F,S.* Presentation of material not normally available in regular course offerings or offering of new courses on a trial basis. Credits and content determined by faculty member in consultation with the Department Head.

TECHNOLOGY EDUCATION

TED 115 **Wood Processing.** *3(1-4) F, S.* Basic knowledge and skills needed to design and construct functional wood products. Includes a study of the tools, materials and processes used to machine, form, assemble and finish wood products. Laboratory activities in the design and construction of wood products. Teaching techniques are discussed. DeLUCA

TED 122 **Metal Technology.** *3(1 4) F,S.* Introduction to metal layout, cutting, machining, forming, fabricating, finishing processes, and current technologies. Experience in oxyacetylene welding, arc welding, gas tungsten arc welding, sheet metals, bench metals, heat-treating, and foundry work.
HAYNIE

TED 221 Construction Technology. *3(1-4) S.* Overview of structures and their construction. Drawings and models completed in a laboratory environment to simulate construction methods.

TED 231 Design for Technology Education. *Preqs: GC 101 or GC 120, TED 115. 3(1-4).* Design and development of products and projects. Class and laboratory exercises with a variety of materials in a diversity of design applications.

TED 246 Graphic Arts Technology. *3(1-4).* Introduction to graphic arts technology. Basic skills are developed through laboratory experiences in photography and the fundamental processes associated with offset lithography, letterpress, and screen printing.

PETERSON

TED 351 General Ceramics. *3(1-4).* Work with ceramic materials as a medium of expression. A study of the sources of clay, and the designing, forming, decorating, and firing of ceramic products.

TED 359 Electrical Technology I. *Preqs: MA 111, PY 212 or 221. 3(2-2).* Direct current, alternating current, and semiconductors. Measurement and circuit behavior. Experimentation with application circuits.

HAYNIE

TED 360 Electrical Technology II. *Preq: TED 359. 3(2-2).* Continuation of Electrical Technology I with special emphasis on the application of digital logic and electronic communication principles in consumer and industrial products. Circuit construction and troubleshooting.

HAYNIE

TED 384 Computer Applications in Industry. *3(1-4) S.* Computerized control systems used in industry including computers and controllers, automated machines, and robots. Students design and operate automated systems.

TED 430 Manufacturing Technology. *Preqs: GC 120, TED 115 or TED 122. 3(1-4) F.* Manufacturing organization, product design, and production system design. Students design, operate and evaluate a small-scale manufacturing system.

TED 476 Transportation Technology: Energy and Power. *Preqs: MA 111, PY 231. 3(1-4) F.* Theoretical and practical aspects of transportation. Topics include energy, energy conversion, transmission, and control; transportation systems and industries; and conservation of energy. Emphasis on laboratory testing, experimenting, developing; and on the use of equipment.

WENIG

TED 490 Special Problems in Technology Education. *Preqs: Junior level standing and permission of instructor. F, S.* An independent supervised investigation in a defined area of interest in Technology Education.

TEXTILE MATERIALS SCIENCE

TMS 106 Modern Applications in Textile Materials Science. *2(2-0) F.* Introduction to principles of textile materials science involved in the selection, design and utilization of textile materials for functional products. Applications in many nontraditional products such as reinforced composites, biomaterials, geotextiles and specialized apparel.

TMS 210 Yarn and Fabric Formation and Properties. *Preq: TC 105; Coreq: PY 205, or 211. 4(3-2) F.* The basic concepts of yarn formation, weaving, knitting, and nonwoven fabric formation. Emphasis on structure property relationship. Impact on product performance.

TMS 211 Introduction to Fiber Science. *Preqs: T 105, TC 105, or TMS 106; MA 131 or 141. 3(2-2) F, S, Sum.* Properties of fibers related to type and chemical structure. Fiber classification and identification. Reaction to moisture, stress-strain properties, and methods of measuring physical properties. Relationship between polymer structure, fiber properties, and utilization.

TMS 361 Physical Properties of Textile Materials. *Preq: TC 203 or TE 201; MA 341; TMS 211. 3(3-0) F.* Physical properties of textile materials. Thermal, optical, frictional, electrical and moisture properties. Process-structure property relationships, microscopic and macroscopic.

TMS 362 Geometry and Mechanics of Textile Materials. *Preq: MA 341, MAE 314, TMS 361, 3(3 0) S.* Interrelationships between elastic and viscoelastic properties of fibers and fiber assemblies. Influence of strain rate, yarn geometry and fabric geometry on tensile, flexural and torsional properties.

TMS 465 Textile Structural Composites. *Preqs: TMS 362, TE 302, 3(3 0) F.* Processing, structure, and properties of textile structural composites. Polymer, metal, and ceramic matrices. 2 D and 3-D textiles preforms. Mechanics of composites, laminate theory, fracture in brittle matrix systems, failure theories.

TMS 471 Textile Materials Design I. *Preq: TMS 362, 3(1-4) F.* Functional textile materials design, modelling techniques and fault analysis methodologies. Product development from initial design phase, testing, analysis, to prototype production. Project will be completed in TMS 472.

TMS 472 Textile Materials Design II. *Preq: TMS 471, 3(1 4) S.* Advanced elements of textile materials design and development. Process-structure-property relationships of manufacturing processes. Risk and reliability. Design, testing, analysis, and prototype production. Completion of project started in TMS 471.

TMS 492 Special Topics in Textile Materials Science. *Preq: Permission of instructor, 1-3 F,S.* Presentation of material not normally available in regular course offerings or offering of new courses on a trial basis. Credits and content determined by faculty member in consultation with the Department Head.

Selected 500-Level Courses Open To Advanced Undergraduates

TES 500 Fiber and Polymer Microscopy. *Preqs: MA 231, PY 212, T 203, 3(1-4) F.*

TES 505 Textile Instrumentation and Control Systems. *Preqs: MA 341, PY 212 and one course in computer science, 3(3-0) S.*

TES 520 Yarn Processing Dynamics. *Preqs: MA 341 and CI or graduate standing, 3(2-2) F.*

TES 541 Theory and Practice of Knitted Fabric Production and Control. *Preqs: TT 370 and CI, 3(3 0) F.*

TES 549 Warp Knit Engineering and Structural Design. *Preq: TT 443, 3(3 0) S.*

TES 555 Production Mechanics and Properties of Woven Fabrics. *Preqs: MA 341 and CI or grad. standing, 3(2 2) S.*

TES 561 Mechanical and Rheological Properties of Fibrous Material. *Preq: MA 341, 3(3 0) S.*

TES 562 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures. *Preqs: MA 341, PY 208, 3(3-0) F.*

TES (MAT) 563 Characterization of Structure of Fiber Forming Polymers. *Preqs: MA 341, PY 208, 3(3-0) F.*

TES 589 Special Studies in Textile Engineering and Science. *Preq: Sr. or grad. standing, 1-4 F,S.*

TES 590 Special Projects in Textile Engineering and Science. *Preqs: Sr. or grad. standing, CI, 2-3 F,S,Sum.*

TOXICOLOGY

TOX 495 Special Topics in Toxicology. *1 3 F,S,Sum.* Offered as needed to present materials unavailable in regular course offerings or for offering new courses on a trial basis.

Selected 500-Level Courses Open to Advanced Undergraduates

TOX 501 General Toxicology. *Preq: BCH 451, sr. or grad. standing. 3(3-0) F.*

TOX 510 Biochemical Toxicology. *Preq: Biochemistry, sr. standing. 3(3-0) S.*

TOX 515 Environmental Toxicology. *Preq: Two years of biology. 3(3 0) F.*

TOX (ST) 563 Statistical Problems in Toxicology. *2(2 0) S. Alt. yrs. (See Statistics)*

TEXTILE SCIENCE

TS 460 Physical Properties of Textile Fibers. *Preqs: MA 212, PY 212. 3(3 0) F, S.* Structural and physical properties of textile fibers including mechanical, thermal, optical, frictional, electrical and moisture properties. The relationships between structure, properties and performance are considered. GRADY, TUCKER

TS 461 Mechanical Properties of Fibrous Structures. *Preqs: MA 341, TS 460. 3(3-0) S.* Interrelationships between elastic and viscoelastic mechanical properties of single fibers and assemblies of fibers. Emphasis placed on how uniqueness of fibers as elements of matter translate into assemblies also having unique properties. Assemblies covered include yarns, fabrics and fiber reinforced composites.

TEXTILE TECHNOLOGY

TT 220 Yarn Production Systems. *Preqs: MA 111, T 105. 3(2 2) F, S, Sum.* The principles of drafting, drawing and twist. Errors in drafting. Review of yarn numbering. Fiber opening, cleaning and blending. Short- and long staple yarn production. Fiber and filament production. Texturing. Quality control.

TT 250 Textile Fabrics: Formation and Structure. *Preqs: T 105 and MA 111. 3(2 2) F, S, Sum.* Basic concepts in weaving, knitting and nonconventional fabric production systems. Fundamentals of the conversion of fibers and yarns into fabrics. Relationships of fabric design, construction and raw materials with properties and performance of end product.

TT 305 Fiberweb and Nonwoven Production. *Preqs: TC 203, PY 211 or 205; Coreqs: ST 361, PY 212 or 208. 3(2-2) F.* Fiberweb nonwoven fabrics produced directly from fibers or their precursors. Physical and chemical nature of local bonding and fiber entanglement. Viable processes for producing these fabrics. Economic justification for process and production. Plant visits whenever possible. BATRA, GILMORE

TT 320 Mechanics of Spun Yarn Manufacturing Systems. *Preq: TT 220; Coreq: TMS 211. 4(3 2) F, S.* Machine fiber interactions in spun yarn manufacturing processes such as: blending, carding, drafting, spinning and packaging. Analysis of factors affecting production rate and quality requirement for conventional and new emerging technologies.

TT 341 Knitting Systems. *Preq: TT 250. 3(2 2) F, S.* Technology of producing knitted fabrics. Range of fabric structures. Emphasis on yarn preparation for knitting, basic mechanics associated with weft and warp knitting machines, patterning mechanisms, technologies of production, new developments and management of knitting operations. SMITH

TT 350 Fabrics and Their End Uses. *Preqs: Both TT 220 and TT 250 or T 200. 3(2 3) S.* A basic course in the relationship of end use applications to the style and design of textile fabrics. Influence of current manufacturing technology will be discussed and the consumer viewpoint emphasized. MASSEY

TT 351 Weaving Systems. *Preq: TT 250. 3(2 2) F, S.* Technology of producing woven fabrics, yarn preparation for weaving, basic loom mechanisms for shuttle and shuttleless looms, new developments and management of weaving operations. GHOSH, MOHAMED

TT 370 Technical Fabric Design. *Prq: Two courses out of TT 341, 351 and 305. 4(3-2) S.* Properties of woven, knitted and nonwoven fabrics. Computer techniques and other methods of reproducing structural designs and means of designing fabrics to specifications. Laboratory consists of projects involving design analysis and testing.

DONALDSON

TT 405 Contemporary Nonwoven Textiles. *Prqs: TT 305, senior standing and consent of instructor. Limited to 25 students. 3(1-4) S.* Group studies of selected nonwoven textile products and processes with format characteristics of contemporary R&D performed in a studio setting. Groups will pursue advanced study of systems for direct conversion of fiber to fabrics including plant, processes and equipment layout, labor assignment, costs of manufacture, material flow, capital cost and market projections. BATRA, GILMORE

TT 420 Modern Developments in Yarn Manufacturing. *Prq: Senior standing. 3(3-0) S.* The modern and emerging systems of yarn manufacturing with emphasis on the economic consequences of changes. Optimization of new and existing equipment to minimize costs and maximize the competitive position of the user. OXENHAM

TT 425 Textured Yarn Production and Properties. *Prqs: TC 203, TMS 211, TT 220, PY 211. 3(2-2) F.* Structure and properties of continuous filament yarns. Examine response to elevated temperature and variables for texturing methods of producing bulked, textured and torqued yarns. Testing of yarn behaviors and discussion of problems encountered during processing. EL SHIEKH, OXENHAM, TUCKER

TT 443 Advanced Knitting Systems and Fabrics. *Prq: TT 341. 3(2-2) F.* Loop forming concepts and mechanisms of complex warp and weft-knitted fabrics. Structural design and limitations, potential applications and knitability. Analysis of mechanical systems and tensioning forces on fabric formation. The effect on dimensional and mechanical properties. LITTLE, SMITH

TT 450 Advanced Weaving. *Prq: TT 351. 3(2-2) F. Alt. yrs.* New developments in weaving machinery, weaving of specialty fabrics and organization of weaving operations. GOSH, MOHAMED

TT 451 Advanced Woven Fabric Design. *Prq: TT 370. 3(2-2) F. Alt. yrs.* Design and production requirements for highly specialized woven fabric structures. The laboratory activities will include a project on design from concept to final production and finishing. MOHAMED, SEYAM

VETERINARY MEDICINE

VMF 401 Poultry Diseases. *4(3-3) S.* The major infectious, noninfectious and parasitic diseases of poultry are studied with respect to economic importance, etiology, susceptibility, dissemination, symptoms and lesions. Emphasis upon practices for prevention, control and treatment of each disease.

VMF 420 Diseases of Farm Animals. *Prq: CH 103. 3(3-0) S.* Pathology of bacterial, viral, parasitic, nutritional, thermal and mechanical disease processes for farm animals. Emphasis on practices for prevention and control of each disease.

VMS 490 Special Topics in Veterinary Medicine. *Prq: Approval of department. Undergraduate students only. 1-6 F,S,Sum.* Offered as needed to cover new or special subject matter within the scope of veterinary medicine at the undergraduate level.

Selected 500-Level Courses Open To Advanced Undergraduates

VMS 530 Veterinary Histology. *Prqs: BCH 451 and CI. 3(2-4) Alt. F.*

VMS 540 Research Animal Care and Use. *Prq: ZO 201 or equivalent. 3(2-3) Alt. S.*

VMS 590 Special Topics in Veterinary Medical Sciences. *Prq: Sr. or grad. standing. 1-3 F,S,Sum.*

WOOD AND PAPER SCIENCE

WPS 101 Introduction to Wood and Paper Science. *1(1 0) F.* Wood utilization in solid, fiber, and chemical form. Curricula and careers in wood utilization.

WPS 102 Introduction to Pulp & Paper Science & Technology. *1(1-0) S.* Introduction to terminology and technology specific to the pulp and paper industry. JOYCE

WPS 202 Wood Structure and Properties I. *Preq: BS 100 or BO 200. 3(2 3) S.* Formation, anatomy, and properties of wood. Structural features of softwoods and hardwoods and the relationships among anatomy, physiology, physical and mechanical properties. Variability, naturally occurring defects, and wood deterioration are discussed and related to wood utilization. Techniques on hand lens and microscopic identification of wood. WHEELER

WPS 203 Wood Structure and Properties II. *Preqs: WPS 202, PY 211. 4(3-2) S.* Physical properties of wood, specific gravity relationships, wood in relation to moisture, heat, sound, light, electricity, combustion, introduction to strength properties of wood. HART

WPS 205 Wood Products Practicum. *Preq: WPS 202 or 203. 5 Sum.* Preparation of drawings and bill of materials for a furniture item. Parts are machined, assembled, and finished. Lumber grading, drying, and gluing principles. Four to five days are spent visiting industries to provide an appreciation for products and processes. The student is responsible for room and board; transportation is provided. BRYAN, KELLY

WPS 210 Wood Products Internship. *Preq: Completion of summer practicum. 1 F,S,Sum.* Experience in the forest products or related industries with a departmentally selected employer.

WPS 211 Pulp and Paper Internship. *Preq: Completion of soph. year. 1.* Experience in the pulp and paper industry. Problem solving in an industrial setting to gain insight of pulp and paper technology. Written report required. HEITMANN

WPS 215 Pulping Technology. *Preqs: CH 107. 3(3-0) F.* Physical and chemical characteristics of wood and cellulose. Chemistry and technology of major mechanical, chemical and semichemical processes employed in the manufacture of pulp and paper. CHANG

WPS 216 Papermaking Technology. *Preq: WPS 215. 3(3-0) S.* Processing of fibers into paper via the many commercial systems used in the paper industry. HEITMANN

WPS 240 Wood Products. *3(3-0) F.* Introduction to forest products industries, including the economic importance, current manufacturing technology, raw material requirements and the future of the industries. THOMAS

WPS (FOR) 273 Quantitative Methods in Forest Resources. *3(2 2) S.* (See Forestry)

WPS 301 Wood Processing I. *Preqs: WPS 202 or WPS 203; WPS 205. 4(3 2) F.* The processes of drying, gluing, and finishing wood. Insect, fungal, and thermal degradation of wood. Drying procedures, glued wood products, furniture and panel finishing, and treatments to prevent biological and thermal degradation. Current industrial equipment and processes. KELLY

WPS 302 Wood Processing II. *Preqs: WPS 202 or WPS 203; WPS 205. 4(3-2) S.* Theories and techniques of processing raw wood into useable products. Principles of operation of current industrial wood milling equipment including primary and secondary processing. Machining of reconstituted wood products.

WPS 310 Paper Properties and Additives. *Preq: Jr. standing in PPT. 3(2-3) F.* Standard testing methods for paper and paperboard: measurement and characterization of the structural, mechanical, and optical properties of paper. Effect of additives on paper properties. Relationship between paper properties and end use requirements. OLF

WPS 316 Wood-Polymer Principles. *Preqs: WPS 203; CH 103 or 107. 4(4 0) S.* Basic organic chemical and polymeric terminology and principles necessary for understanding the chemical components and macrostructure of wood as well as the adhesives and finishes

used in wood products manufacturing. The chemical and physico-chemical properties of wood based on polymeric chemical structure. Finishing and adhesive systems used in wood products manufacturing.

WPS 332 Wood and Pulp Chemistry. *Preqs: CH 221, 223; PY 205, PY 208; CH 331 or CH 431 or CHE 315, 4(3-3) S.* Introduction to carbohydrate chemistry focusing on the structure and reactivity of wood polysaccharides, hemicelluloses and cellulose and on the chemical structure of lignins and wood extractives. Special emphasis on the chemical reaction of wood components occurring in pulping and bleaching processes. GRATZL

WPS 344 Introduction to Quality Control in Wood Products. *Preq: ST 361, 3(3-0) S.* Statistical quality control techniques applicable to the manufacture of wood products. Control chart techniques for monitoring defects, defectives and measurements. Acceptance sampling procedures. Examples from the wood products industries will be used. HART

WPS 350 Wood Products Literature. *Preq: Junior standing in Wood Products, 2 (variable) S.* Exploration of the wood products literature; use of library services, oral and written reports, with emphasis on independent study. KELLY, WHEELER

WPS 355 Pulp and Paper Unit Processes I. *Preq: CHE 205; WPS 215. Not open to PPT Chemical Engineering Concentration students, 3(3 0) S.* Selected topics in chemical engineering as applied in the pulp and paper industry. Emphasis on computational practice. KIRKMAN

WPS 360 Pulp and Paper Unit Processes II. *Preqs: WPS 355 or CHE 311, WPS 215; Coreq: WPS 322, 3(3 0) F.* Application of chemical engineering principles to the analysis of pulp and paper unit processes. Emphasis on practical problems in fluid dynamics, heat transfer, mass transfer, and thermodynamics. JAMEEL

WPS 410 Modeling and Simulation of Pulp and Paper Processes. *Preqs: WPS 215, 216, 360, 3(2-2) S.* Application of modeling and simulation techniques for the analysis of pulp and paper processes. Model development and computer simulations using existing models are required to study process variable interactions and process modifications. KIRKMAN

WPS 415 Project Management and Analysis I. *Preq: Sr. Standing in PRT, 2(2 0) F.* The first in a two-course sequence concerned with the design, management, and analysis of technical projects. Practice in written and oral presentation of results. JAMEEL, JOYCE

WPS 416 Project Management and Analysis II. *Preq: WPS 415, 3(2-3) S.* The second of a two course sequence concerned with the design, management, and analysis of technical projects. Emphasis on concepts and techniques used in economic analysis of projects. Teams work on projects involving the design and economic analysis of projects that can be implemented in a mill. A detailed final report and presentation of the project required. JAMEEL, JOYCE

WPS (FOR) 423 Forest Machinery and Systems. *Preq: Junior standing in FOR, WP or BAE, 3(2-3). (See Forestry Department)*

WPS (FOR) 434 Management Decision Making in Forestry and Wood Products. *Preqs: MA 131 and 231, 3(3 0) F. (See Forestry Department)*

WPS 441 Wood Mechanics. *Preqs: MA 231, PY 212, 4(3-3) F.* Statics and forces in trusses. Elementary and orthotropic elasticity. Beam theory including effect of shear. Elastic stability and design of columns and beams. Effect of wood anatomy on mechanical properties and failure. Influence of density, age, growth stresses, moisture, temperature and duration of load. Creep and mechanosorptive deformation. Visual and mechanical grading. Derivation of allowable values. Structural fasteners. KASAL

WPS 444 Wood Composites. *Preq: Senior standing in Wood Products, 3(3 0) S.* Manufacture, properties, and processing of wood-based composites. Commodity products plywood, particleboard, waferboard, and oriented strandboard as well as specialty composite products. KASAL, KELLY

WPS 450 Wood Industry Case Studies. *Preq: Sr. standing in WP. 2(1-3) S.* Presentation of relevant wood industry problems involving material selection, processing and managerial techniques. Causes of in-use failures of wood products and means of prevention.

KELLY

WPS 460 Environmental Issues in the Paper Industry. *Preq: Senior standing in PPT. 2(2-0) F.S.* Survey of environmental problems in the paper industry. Options for in plant process modifications to minimize pollutant production. External treatment technologies.

WPS 471 Pulping Process Analysis. *Preq: WPS 215, 216. 3(1-6) F.* Preparation and evaluation of different types of wood pulp. A new wood raw material is selected each year with the purpose of studying and critically evaluating the principal pulping and bleaching variables.

JAMEEL

WPS 472 Paper Process Analysis. *Preqs: WPS 215, 216. 3(1-6) S.* Manufacture of several types of papers with attention to stock preparation, sizing, filling and coloring. The finished products are tested physically and chemically and evaluated.

HEITMANN

WPS 475 Process Control in Pulp and Paper. *Preq: Sr. Standing in PPT; Coreq: WPS 410. 3(2-3) F.* Overview of the various aspects of control including process modeling, design of control loops, and stability analysis in pulp and paper. Emphasis on distributed digital control (DDC), including hands-on programming and control loop development on a DDC computer.

WPS 482 Projects in Wood Products. *Preq: Senior standing in WP. 2 F.S.Sum.* Individual library or laboratory research projects selected and conducted with the approval and guidance of faculty.

WPS 491 Special Topics in Wood and Paper Science. *1-4 F.S.Sum.* Independent study of management or technology problems selected with faculty approval or the offering of experimental courses.

Selected 500-Level Courses Open To Advanced Undergraduates

WPS 513 Tropical Woods. *Preq: WPS 202. 2(1-3) Alt. F.*

WPS 515 Surface and Colloid Chemistry of Papermaking. *Preq: CH 331 or CH 431. 3(3-0) Alt. S.*

WPS 521 Chemistry of Wood Polysaccharides. *Preqs: CH 223 and WPS 332 or BCH 451. 3(3-0) Alt. F.*

WPS 522 Chemistry of Lignin and Extractives. *Preqs: CH 223 and WPS 322 or BCH 451. 3(3-0) Alt. S.*

WPS 525 Pollution Abatement in Forest Products Industries. *Preq: Grad. or advanced undergrad. standing in science or engineering curricula. 3(3-0) F. Alt. yrs.*

WPS 533 Advanced Wood Anatomy. *Preq: WPS 202 or CI. 3(1-6) F. Alt. yrs.*

WPS 540 Wood Composites. *Preqs: WPS 441; grad. or advanced undergrad. standing. 3(3-0) Alt. S.*

WPS 560 Advanced Pulp and Paper Process Analysis. *Preqs: WPS 215 and 216. 3(3-0) S. Alt. yrs.*

ZOOLOGY

ZO 201 General Zoology. *Preq: BS 100 or 105. 4(3-3) F.S.Sum.* Biology of the major groups of animals, with emphasis on general structural plans and diversity, reproduction, development, ecology, behavior and evolution.

ZO 205 Introduction to Cellular and Developmental Zoology. *Preq: BS 100. 4(4-0) F.* Basic concepts and principles of cellular and developmental zoology with emphasis on cellular chemistry, structure and function. Molecular biology, differentiation, and processes involved in morphogenesis.

ROBERTS

- ZO 208 Introduction to Organismal and Evolutionary Zoology.** *Preq: BS 100. 4(4-0) S.* Basic concepts of organismal zoology. Principles of evolution, ecology, behavior, physiology and morphology. Introduces various animal phyla in which these principles are applied to living organisms. **WALTERS**
- ZO 212 Basic Anatomy and Physiology.** *Preq: BS 100. 4(3-3) F.* Major emphasis on the structure and function of the muscular, skeletal, circulatory and nervous systems.
- ZO (MEA) 220 Marine Biology.** *Preq: MEA 200 or BS 100. One weekend field trip required. 3(3 0) S.* (See Marine, Earth, and Atmospheric Sciences)
- ZO (FW) 221 Conservation of Natural Resources.** *3(3 0) F,S,Sum.* (See Fisheries and Wildlife Sciences)
- ZO 290 Special Topics in Zoology.** *Preq: BS 100. 1 4 Periodically.* Variable use for introductory courses to be taught experimentally.
- ZO 303 Vertebrate Zoology.** *Preq: ZO 201 or ZO 208. 3(3-0) F,S.* Biology of the vertebrates; their adaptations and evolutionary history. Comparative physiological, developmental, behavioral and anatomical studies. **BARTHALMUS**
- ZO 304 Vertebrate Zoology Laboratory.** *Coreq: ZO 303. 1(0-3) F,S.* Anatomical studies of selected invertebrate and vertebrate members of the phylum Chordata. Functional morphology, evolution, and dissection of preserved specimens. Coordinated with ZO 303. **BARTHALMUS**
- ZO 305 Cellular and Animal Physiology Laboratory.** *Preq: ZO 205. 2(0-5) F,S.* Cellular and physiological techniques and experimentation. Experiments on cells and functions of animal organ systems.
- ZO 315 General Parasitology.** *Preq: ZO 201 or ZO 208. 3(2-3) S.* Life history, pathology and control of some common parasites of humans and important wild and domestic animals. **MILLER**
- ZO (FW) 353 Wildlife Management.** *Preqs: ZO 201 or ZO 208. 3(3 0) F.* Historical development of Wildlife Management from anecdotal, observational practices to modern, scientific approaches used around the world. Principles of population analysis, management, protection and conservation of animals, particularly those of conservation, aesthetic, sport or food values in urban, rural and wilderness areas. Ethics of hunting and trapping. Contradictory objectives challenging modern wildlife managers.
- ZO (BO) 360 Introduction to Ecology.** *Preq: A 200 level biology course. 3(3-0) F,S,Sum.* Science of ecology, including factors which control distribution and population dynamics of organisms, structure and function of biological communities, and energy flow and nutrient cycling in ecosystems; contrasts among the major biomes; and principles governing ecological responses to global climatic and other environmental changes.
- ZO 361 Principles of Embryonic Development.** *Preq: ZO 205 or ZO 208 or ZO 303. 3(3 0) F,S.* The basic principles of embryonic development are revealed through an integrated study of descriptive and experimental embryology. The development of both invertebrates and vertebrates is considered at levels of organization ranging from molecular to organismal.
- ZO (BO) 365 Ecology Laboratory.** *Preq. 1(0-3) F,S,Sum.* (See Botany)
- ZO 365H Honors Ecology Laboratory.** *Preq: GPA 3.0 or higher; Coreq: ZO 360. Credit not allowed for both 365 and 365H 1(0 3) F.* Honors laboratory coordinated with ZO (BO) 360 lecture, provides introductory observations in laboratory and field settings. Two laboratory reports in scientific format and occasional duties outside scheduled hours are required. Optional weekend field trips out of town, housing and food at student expense. **MOZLEY**
- ZO 370 Developmental Anatomy and Histology of the Vertebrates I.** *Preq: ZO 201 or ZO 208; Coreq: ZO 375. 3(3 0) F.* An integrated study on the embryonic development, gross anatomy, microanatomy, and phylogeny of vertebrate organ systems; surface and connective tissues, the skeleton, and the muscular system. **BLACK, BRADBURY**

- ZO 371 Developmental Anatomy and Histology of the Vertebrates II.** *Preq: ZO 370; Coreq: ZO 376. 3(3 0) S.* An integrated study of the embryonic development, gross anatomy, microanatomy, and phylogeny of vertebrate organ systems; the circulatory, respiratory, digestive, urogenital, endocrine, and nervous systems. BLACK, BRADBURY
- ZO 375 Developmental Anatomy and Histology Laboratory I.** *Preq: ZO 201 or ZO 208; Coreq: ZO 370. 2(0 6) F.* Vertebrate organ systems utilizing dissections of preserved specimens of embryos and tissue preparations; early embryonic development, surface and connective tissues, the skeleton, and muscular system. BLACK, BRADBURY
- ZO 376 Developmental Anatomy and Histology Laboratory II.** *Preq: ZO 370 and ZO 375; Coreq: ZO 371. 2(0 6) S.* Vertebrate organ systems utilizing dissections of preserved specimens and microscopic examination of embryos and tissue preparations; late embryonic development and the circulatory, respiratory, digestive, urogenital, endocrine, and nervous systems. BLACK, BRADBURY
- ZO 402 Invertebrate Zoology.** *Preq: ZO 201 or 208. 2(2 0) S. Even yrs.* Survey of invertebrate phyla, excluding the Protista, emphasizing their functional biology. BRADBURY
- ZO 403 Invertebrate Zoology Laboratory.** *Preq: ZO 201 or 208. 2(0-6) S. Even yrs.* Examination of living and preserved invertebrates to study their distinguishing characteristics and to observe anatomical modifications for function. BRADBURY
- ZO 410 Introduction to Animal Behavior.** *Preqs: ZO 201, or 208, or 303. 3(3 0) F.* Studies of animal behavior in vertebrates and invertebrates including physiological mechanisms and adaptive significance. VANDENBERGH
- ZO (BO) 414 Cell Biology.** *Preqs: CII 223, PY 212, ZO 205 or 303. 3(3-0) S.* The chemical and physical bases of cellular structure and function with emphasis on methods and interpretations. ROBERTS
- ZO 419 Limnology.** *Preqs: BO (ZO) 360, CH 107. Credit in both ZO 419 and ZO 519 is not allowed. 4(3-3) F.* Structure and function of lakes and ponds, including physical, chemical and biological controls of productivity and species composition of aquatic plants and animals, and effects of pollution on water quality. One local weekend field trip is required. MOZLEY
- ZO (FW) 420 Fishery Science.** *Preqs: ZO 201 or 303; ZO 360. 3(2 2) F.* (See Fisheries and Wildlife Sciences)
- ZO 421 Principles of Physiology.** *Preqs: CH 223, ZO 205 or equivalent. 3(3-0) F.S.Sum.* A comprehensive survey of the processes involved in the function of specialized cells, tissues and organ systems. Emphasis on basic concepts with orientation toward mammalian and human systems. SMITH, UNDERWOOD
- ZO 422 Biological Clocks.** *Preqs: ZO 205, ZO 208. Credit in both ZO 422 and ZO 522 is not allowed. 3(3-0) S.* The anatomy, physiology, and development of biological clocks in a variety of organisms, including humans. UNDERWOOD
- ZO (ENT) 425 General Entomology.** *Preq: ZO 201 or equivalent. 3(2 3) F.Sum.* (See Entomology)
- ZO (FW) 430 Fisheries and Wildlife Administration.** *Preqs: PS 201, PS 202; FW (ZO) 420, FW (ZO) 353. 3(3 0) S.* (See Fisheries and Wildlife Sciences)
- ZO 441 Biology of Fishes.** *Preqs: ZO (BO) 360. 3(3-0) F.* Behavior, evolution, physiology and ecology of fishes, emphasizing their adaptations for life in streams, lakes, and oceans. MILLER
- ZO 442 Biology of Fishes Laboratory.** *Preq: BO (ZO) 360; Coreqs: ZO 441. 1(0-3) F.* Field and laboratory exercises with the common fish species and communities of North Carolina. Field trips to local streams and lakes plus weekend trips to coastal, estuarine, and mountain habitats. MILLER

ZO 450 Evolutionary Biology. *Preq:* ZO 205, ZO 208, GN 411 recommended. 3(3 0) F. Principles and patterns of organic evolution. Origin of life, patterns of genetic variability within populations; adaptations, natural selection, and the formation of species. The living world as a historical process governed by diverse principles of organization. GILLIAM

ZO 460 Aquatic Natural History Laboratory. *Preqs:* Two BO and/or ZO courses. 2(0 6) S. Field and laboratory study of common freshwater organisms other than fish and birds. Emphasis on taxonomy of orders and some families, and adaptations of structure and behavior to aquatic environments. Effect of pollution, conservation approaches and aquarium culture. Several weekend field trips required. MOZLEY

ZO 480 Laboratory Techniques in Cellular Biology. *Preq:* ZO 305, CH 223. 3(0-6) F, S. Selected laboratory techniques utilized in modern biological research including immunocytochemistry, tissue culture, microscopy, and the detection and isolation of recombinant proteins expressed in bacteria. ROBERTS

ZO 492 External Learning Experience. *Preq:* Sophomore standing. 1 6 F, S. A learning experience in agriculture and life sciences within an academic framework that utilizes facilities and resources which are external to the campus. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer and the departmental teaching coordinator prior to the experience.

ZO 493 Special Problems Research Exploration. *Preq:* Sophomore standing. 1-6 F, S. A learning experience in agriculture and life sciences within an academic framework that utilizes campus facilities and resources. Contact and arrangements with prospective employers must be initiated by student and approved by a faculty adviser, the prospective employer, the departmental teaching coordinator prior to the experience.

ZO 495 Special Topics in Zoology. *Preq:* Twelve hours ZO. 1-3 F, S, Sum. Offered as needed for development of new courses in various areas of zoology.

Selected 500-Level Courses Open To Advanced Undergraduates

ZO 501 Ornithology. *Preqs:* BO (ZO) 360; ZO 201 or ZO 303. 3(2 3) Even yrs. S.

ZO (PHY) 503 General Physiology I. *Preq:* Sr. or grad. standing. The following courses are recommended: ZO 421 or equivalent, BCH 451 or equivalent, a year of physics. 3(3 0) F.

ZO (PHY) 504 General Physiology II. *Preq:* ZO (PHY) 503. 3(3 0) S.

ZO (ENT) 509 Ecology of Stream Invertebrates. *Preqs:* ZO 201 or 208, BO (ZO) 360 or equivalent. 4(2-6) S, odd yrs.

ZO 512 Animal Symbiosis. *Preq:* 12 hrs. of biology and zoology. 3(3-0) S, odd yrs.

ZO (PHY) 513 Comparative Physiology. *Preq:* ZO 421 or CI. 4(3-3) F, odd yrs.

ZO (FW) 515 Fish Physiology. *Preqs. or Coreqs:* GN 411, ZO 420, 421, 441. 3(2-3) F, odd yrs.

ZO (MEA) 520 Principles of Biological Oceanography. *Preqs:* BO (ZO) 360 or grad. standing. 3(3 0) S.

ZO (PO) 524 Comparative Endocrinology. *Preq:* ZO 421 or equivalent. 4(3-3) S.

ZO 544 Mammalogy. *Preq:* ZO 303. 4(3-3) F.

ZO (FW) 553 Principles of Wildlife Science. *Preq:* ZO (BO) 360. 3(2 3) F.

ZO (MB) 555 Protozoology. *Preq:* CI. 4(2 6) S, Odd yrs.

ZO (BO) 560 Principles of Ecology. *Preq:* Three semesters of college level biology courses. 4(3 3) F.

ZO (ENT) 582 Medical and Veterinary Entomology. *Preqs:* ENT 312 or 425 and ZO 315 or equivalent 3(2 3) Alt. S.

- ZO (FW) 586 **Aquaculture I.** *Preqs: ZO (BO) 360, sr. or grad. standing. 3(3 0) F, even yrs.*
- ZO (FW) 587 **Aquaculture I Laboratory.** *Preqs: ZO (BO) 360, sr. or grad. standing; Coreq: ZO 586. 1(0 3) F, even yrs.*
- ZO 590 **Special Studies.** *Preqs: Twelve hours ZO and CI. Credits arranged. F,S.*
- ZO 592 **Topical Problems.** *Preq: CI. 1 3 F,S.*
- ZO 593 **Aquatic Ecology Seminar.** *Preqs: Grad., PBS, or sr. standing; one course in aquatic, marine or fisheries area. 1-3 F,S.*

The University of North Carolina

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

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

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

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

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

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

Each of the 16 constituent institutions is headed by a chancellor, who is chosen by the Board of Governors on the president's nomination and is responsible to the president. Each institution has a board of trustees, consisting of eight members

elected by the Board of Governors, four appointed by the governor, and the president of the student body, who serves ex-officio. (The NC School of the Arts has two additional ex-officio members.) Each board of trustees holds extensive powers over academic and other operations of its institution on delegation from the Board of Governors.



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North Carolina State University

HISTORICAL SKETCH

On March 7, 1887, the North Carolina General Assembly passed the act which authorized the establishment of the North Carolina College of Agriculture and Mechanic Arts. The Watauga Club of Raleigh and the statewide farmers' movement had convinced the legislature of the need to transfer the funds received by the state under the provisions of the Morrill Land-Grant Act of 1862 from the University of North Carolina in Chapel Hill to a new land grant college in Raleigh. The cornerstone of A. and M. College was laid in August, 1888, and its doors were officially opened on October 3, 1889.

Alexander Q. Holladay, the college's first president (1889-1899), and a faculty of five offered courses in agriculture, horticulture, pure and agricultural chemistry, English, bookkeeping, history, mathematics, physics, practical mechanics, and military science. The first freshman class numbered about fifty students. By the end of the institution's first decade the resident enrollment had reached 300.

During the administration of **George T. Winston** (1899-1908) a new curriculum in textiles was developed and normal courses were offered in the summer for public school teachers, both men and women. The Agricultural Extension Service was established during the administration of **Daniel H. Hill** (1908-1916) and enrollment grew to more than 700. In 1917, during the administration of **Wallace C. Riddick** (1916-1923), the institution's name was changed to North Carolina State College of Agriculture and Engineering. The introduction of the word engineering was intended to reflect the increasing emphasis on the professional and theoretical as well as the practical aspects of technical education.

In 1923 a major reorganization of the administration of the college was begun, and President Riddick resigned to become the first dean of the new School of Engineering. **Eugene Clyde Brooks** (1923-1934), the fifth president of State College, continued the reorganization with the creation of the School of Agriculture (later renamed the School of Agriculture and Forestry), the School of Science and Business, the School of Education, the School of Textiles, and the Graduate School. Resident enrollment rose to nearly 2,000 in 1929 before the Depression caused a drop to approximately 1,500 in 1933. The first women graduates of State College received their degrees in 1927.

In the midst of the Depression the General Assembly of 1931 attempted to promote economy and to prevent unnecessary duplication among the three leading state institutions of higher education by establishing a single consolidated administration for the University of North Carolina in Chapel Hill, North Carolina State College of Agriculture and Engineering, and North Carolina College for Women in Greensboro. Dr. Frank Porter Graham, president of the University of North Carolina, was elected president of the consolidated university, and Dr. Brooks, with the title of vice president, continued as chief administrative officer at State College. Among the consequences of consolidation were the phasing out of the School of Engineering at Chapel Hill and the School of Science and Business at Raleigh. A general college, later called the Basic Division, was

established to provide two years of basic courses in humanities, social sciences, and natural sciences as a foundation for students in the various degree-granting technical and professional schools.

Colonel **John W. Harrelson** (1934-1953), Class of 1909, was the first alumnus to become administrative head of State College. Under the consolidated organization his title was Dean of Administration; later it was changed to Chancellor. During Harrelson's administration the institution experienced the beginning of extraordinary growth in the aftermath of World War II. Two new schools were established: the School of Design and the School of Forestry. A multi-million dollar expansion program was completed during the administration of **Carey H. Bostian** (1953-1959), and the program of student activities was greatly enlarged, as the enrollment passed 5,000.

The faculty and student population more than doubled during the administration of **John T. Caldwell** (1959-1975) and another new school was organized: the School of Physical Sciences and Applied Mathematics (now Physical and Mathematical Sciences). The School of General Studies, the successor to the Basic Division, was renamed the School of Liberal Arts and was authorized to offer a full range of bachelor's and master's degree programs in the humanities and social sciences. The name of the institution itself was changed in 1965 to North Carolina State University, signifying its new role as a comprehensive university.

NCSU's enrollment passed 20,000 during the administration of Chancellor **Joab L. Thomas** (1976-1981). The School of Veterinary Medicine was established, the name of the School of Liberal Arts was changed to School of Humanities and Social Sciences, and North Carolina State University was recognized as one of two major research universities within the statewide University of North Carolina.

Bruce R. Poulton (1982-1990) became chancellor in the fall of 1982. A major expansion of the University's research budget, the establishment of a substantial endowment to provide enlarged resources for research equipment and endowed professorships, and the addition of the 1,000-acre Centennial Campus occurred during this administration. All of the schools were renamed colleges except for the School of Design and The Graduate School. In addition, the School of Education became the College of Education and Psychology.

In 1990 **Larry K. Monteith**, an alumnus and former Dean of the College of Engineering, became chancellor and NCSU's eleventh chief administrative officer. Among his early initiatives were the creation of the Division of Undergraduate Studies and the First Year Experience Program. The College of Textiles and ABB (Asea Brown Boveri), NCSU's first corporate partner, moved to Centennial Campus in 1991. In 1992, the College of Management was established.

MISSION OF NORTH CAROLINA STATE UNIVERSITY*

The unique mission of North Carolina State University is to serve the citizens of North Carolina as the State's only research university in the land-grant tradition. Since its founding in 1889, NCSU has been committed to science and technology as pathways to human betterment and has served as an innovative educational resource, providing leadership for positive intellectual, social, and technological change. Faithful to its founding mission, the University must now meet the challenges posed by the increasing complexity of our global society and the accelerated growth in knowledge and technology.

Teaching, research, and public service will continue to be mutually enriching enterprises at NCSU. The activities of research and extension interact to provide students with an environment for learning that stresses creativity, problem solving, social responsibility, and respect for human diversity. The educational and extension functions join to apply, test, and disseminate the new knowledge generated by research.

During the University's first hundred years, its distinctive mandate has led to eminence in science, technology, and engineering. This mandate will continue to shape future development, necessitating excellence in the full spectrum of disciplines that provide the intellectual and critical foundations for understanding, anticipating, and responding to public needs.

Undergraduate education is a major responsibility of NCSU. Core education is provided in science and the humanities, and in professional and technical disciplines. The atmosphere of a research university provides distinctive opportunities for undergraduates to benefit from the experience of research in the classroom, laboratory, and informal settings. Exposure to the discovery and synthesis of new information provides students with a basis for identifying and solving society's problems and builds a critical foundation for their personal growth, cultural enrichment, and professional development.

As a national center for doctoral studies, NCSU embraces the responsibility to maintain excellence in graduate research and education. Students work as partners with faculty in the creation, expansion, conservation, and transmission of knowledge. Graduate education will continue to evolve as the University builds on its traditional and preeminent strengths in science, technology, and engineering and as it develops further strengths in complementary disciplines.

Research and scholarly inquiry form the foundation for education and public service at NCSU. Faculty and students in all disciplines engage in the art and science of discovery in a climate of free inquiry and creativity, extending the boundaries of knowledge and horizons of human intellect. The research mandate of NCSU is signified in its national classification as a Research University I.

The University's land-grant philosophy is manifest in its commitment to active stewardship of the human and natural resources of the State. NCSU has been an integral part of significant economic and technological changes in North Carolina for the past one hundred years. This stewardship is expressed currently

*Approved by the NCSU Board of Trustees on February 23, 1991.

through public service activities in all the University's colleges and schools, whereby the expertise resident among the faculty and students is disseminated across the State through extension, technical assistance, professional development, lifelong education, and technology transfer programs. Loyal to the vision of its founders in the nineteenth century, NCSU will continue to strive through extension and public service to improve the quality of life for North Carolinians into the twenty first century.

NCSU's dual designations as a land-grant university and a Research University I form the basis for the unique role of NCSU in The University of North Carolina. NCSU stands on the threshold of a new century with deep appreciation for the significance of these mandates and the commitment to excellence and change that they jointly require.

POLICY ON ILLEGAL DRUGS

The following policy on illegal drugs was adopted by the North Carolina State University Board of Trustees on April 16, 1988.

Purpose

Reflecting its concern over the threat which illegal drugs constitute to higher education communities, the Board of Governors of the University of North Carolina adopted a policy on illegal drugs on January 15, 1988. The Board of Governors' policy requires each constituent institution's Board of Trustees to develop a policy on illegal drugs applicable to all students, faculty members, administrators and other employees. The policy for each campus must address particular circumstances and needs while being fully consistent with specified minimum requirements for enforcement and penalties.

To assist NCSU in its continuing efforts to meet the threat of illegal drugs, and to comply with the Board of Governors' policy, the Board of Trustees adopts the policy set forth below. This policy is intended to demonstrate the University's primary commitment to education, counseling, rehabilitation, and elimination of illegal drugs, as well as its determination to impose penalties in the event of violation of state and federal drug laws consistent with all due process protection rights.

Education, Counseling, and Rehabilitation

NCSU shall maintain a program of education designed to help all members of the University community avoid involvement with illegal drugs. The educational program shall emphasize the incompatibility of the use or sale of illegal drugs with the goals of the University, the legal consequences of involvement with illegal drugs, the medical and psychological implications of the use of illegal drugs, and the ways in which illegal drugs jeopardize an individual's present accomplishments and future opportunities. Specific elements of the education program are:

1. Publicizing the University's policy in the Student Code of Conduct, the undergraduate and graduate catalogs, and other publications distributed to students, faculty administrators, and other employees. The latter publications include the *Official Bulletin*, the *Student Handbook*, the *Faculty Handbook*, the *Advisers' Handbook*, and the Human Resources newsletter.
2. Continuing and expanding the drug education program conducted by Student Health Service.
3. Continuing development of courses on drug education.
4. Continuing the drug education component of the employees' Wellness Program.
5. Increasing the awareness and utilization of the University's Employee Assistance Program (EAP).

The University shall disseminate information about drug counseling and rehabilitation services that are available to members of the University community. Persons who voluntarily avail themselves of such services shall be assured that applicable professional standards of confidentiality will be observed and that such participation will not be the basis for disciplinary action. Specific counseling and rehabilitation efforts include:

1. Continuing the evaluation and referral services of the Counseling Center for out-patient and in-patient rehabilitation.
2. Continuing the consultation and evaluation portions of the Student Health Service's drug education program.
3. Utilizing the Employee Assistance Program's referral to existing community based counseling and rehabilitation services.

Enforcements and Penalties

Students, faculty members, administrators, and other employees are responsible as citizens, for knowing about and complying with the provisions of North Carolina law that make it a crime to possess, sell, deliver, or manufacture those drugs designated collectively as "controlled substances" in Article 5 of Chapter 90 of the North Carolina General Statutes. The University will initiate its own disciplinary proceeding against a student, faculty member, administrator, or other employee when the offense is deemed to affect the interests of the University. Penalties will be imposed by the University in accordance with procedural safeguards applicable to disciplinary actions against students, faculty members, administrators, and other employees, as required by Section 502D(3) and Section 603 of the University Code, by Board of Governors' policies applicable to other employees exempt from the State Personnel Act, and by regulations of the State Personnel Commission. The penalties to be imposed by the University may range from written warnings with probationary status to expulsions from enrollment and discharges from employment. However, the following minimum penalties, as prescribed by the Board of Governors, shall be imposed for the particular offenses described.

Trafficking in Illegal Drugs

1. For the illegal manufacture, sale or delivery, or possession with intent to manufacture, sell or deliver, of any controlled substance identified in Schedule I, N.C. General Statutes 90-89, or Schedule II, N.C. General Statutes 90-90 (including, but not limited to, heroin, mescaline, lysergic acid diethylamide, opium, cocaine, amphetamine, methaqualone), any student shall be expelled and any faculty member, administrator or other employee shall be discharged.
2. For a first offense involving the illegal manufacture, sale or delivery, or possession with intent to manufacture, sell or deliver, of any controlled substance identified in Schedules III through VI, N.C. General Statutes 90-91 through 90-94 (including, but not limited to, marijuana, phenobarbital, codeine), the minimum penalty shall be suspension from enrollment or from employment for a period of at least one semester or its equivalent.* For a second offense, any student shall be expelled and any faculty member, administrator, or other employee shall be discharged.

Illegal Possession of Drugs

1. For a first offense involving the illegal possession of any controlled substance identified in Schedule I, N.C. General Statutes 90-89, or Schedule II, N.C. General Statutes 90-90, the minimum penalty shall be suspension from enrollment or from employment for a period of at least one semester or its equivalent.
2. For a first offense involving the illegal possession of any controlled substance identified in Schedules III through VI, N.C. General Statutes 90-91 through 90-94, the minimum penalty shall be probation, for a period to be determined on a case-by case basis. A person on probation must agree to participate in a drug education and counseling program, consent to regular drug testing, and accept such other conditions and restrictions, including a program of community service, as the Chancellor or the Chancellor's designee deems appropriate. Refusal or failure to abide by the terms of probation shall result in suspension from

enrollment or from employment for any unexpired balance of the prescribed period of probation.

3. For second or other subsequent offenses involving the illegal possession of controlled substances, progressively more severe penalties shall be imposed, including expulsion of students and discharge of faculty members, administrators or other employees.

Suspension Pending Final Disposition

When a student, faculty member, administrator, or other employee has been charged by the University with a violation of policies concerning illegal drugs, he or she may be suspended from enrollment or employment before initiation or completion of regular disciplinary proceedings if, assuming the truth of the charges, the Chancellor or, in the Chancellor's absence, the Chancellor's designee concludes that the person's continued presence within the University community would constitute a clear and immediate danger to the health or welfare of other members of the University community; provided, that if such a suspension is imposed, and appropriate hearing of the charges against the suspended person shall be held as prompt as possible thereafter.

Coordinator of Drug Education

The University Counsel will serve as coordinator of drug education and, acting under the authority of the Chancellor, will be responsible for overseeing all actions and programs relating to this institutional policy.

Implementation and Reporting

This NCSU policy on illegal drugs shall be effective on the beginning of the fall semester of 1988.

Annually the Chancellor shall submit to the Board of Trustees a report on campus activities related to illegal drugs for the preceding year. The report shall include, as a minimum, the following: (1) a listing of the major education activities conducted during the year; (2) a report on any illegal drug-related incidents, including any sanctions imposed; (3) an assessment by the Chancellor of the effectiveness of the campus program, and (4) any proposed changes in the policy on illegal drugs. A copy of the report shall be provided to the President.

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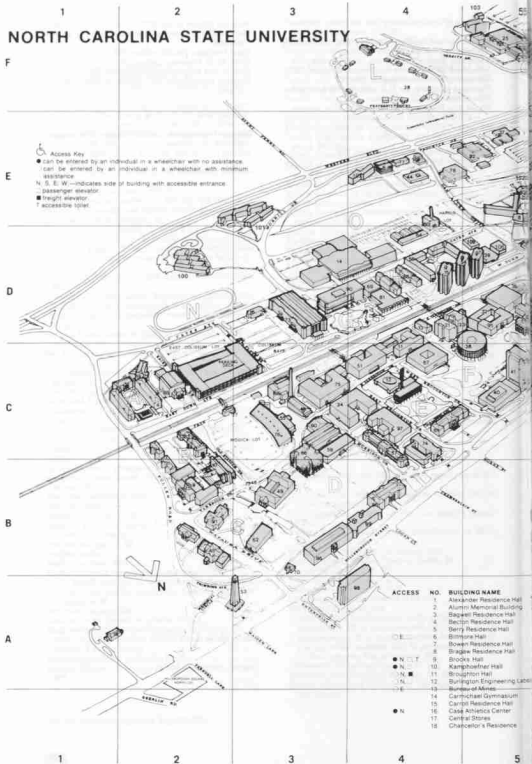
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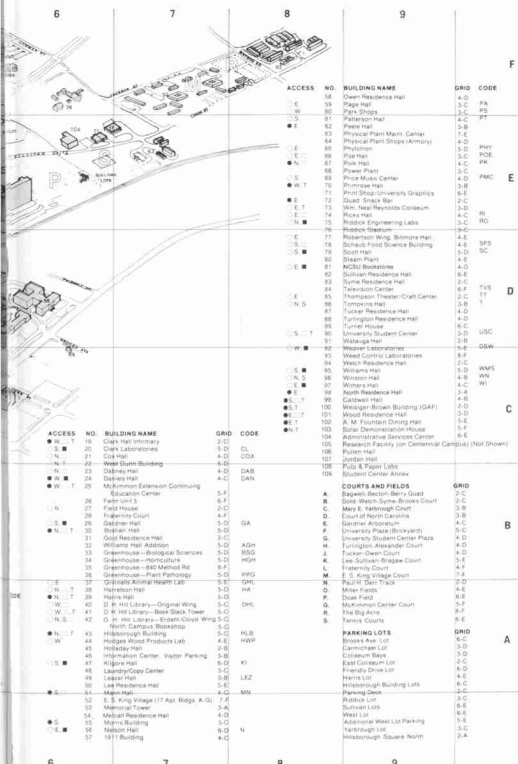
NORTH CAROLINA STATE UNIVERSITY



Access Key

- can be entered by an individual in a wheelchair with no assistance
- ◐ can be entered by an individual in a wheelchair with minimum assistance
- N, S, E, W—indicates side of building with accessible entrance
- ◓ passenger elevator
- ◑ freight elevator
- ◔ accessible ramp

ACCESS NO.	BUILDING NAME
1	Alexander Residence Hall
2	Alumni Memorial Building
3	Bagwell Residence Hall
4	Bacon Residence Hall
5	Berry Residence Hall
6	Simpson Hall
7	Bowen Residence Hall
8	Braggs Residence Hall
9	Brooks Hall
10	Kanglewheeler Hall
11	Broughton Hall
12	Burlington Engineering Lab
13	Bureau of Aeronautics
14	Carrichael Gymnasium
15	Carpi Residence Hall
16	Case Athletics Center
17	Central Stores
18	Chancellor's Residence



ACCESS	NO.	BUILDING NAME	GRID	CODE
W...T	19	Clerk Hall Infirmary	2-C	
S...T	20	Clerk Laboratories	5-D	DL
N...	21	Coj Hall	4-D	DDK
N...E	22	Wood Durin Building	4-D	
N...	23	Osborn Hall	4-D	
W...E	24	Darbels Hall	4-C	DAN
W...T	25	McKinnon Extension Continuing Education Center	5-F	
	26	Farm Unit 5	6-F	
	27	Field House	2-C	
N...	28	Fringery Court	4-F	
S...E	29	Gardner Hall	5-D	GA
N...T	30	Boylan Hall	5-D	
N...T	31	Gold Residence Hall	2-C	
	32	Williams Hall Addition	5-D	ADH
	33	Greenhouse—Biological Sciences	5-D	BSG
	34	Greenhouse—Horticulture	5-D	HGH
	35	Greenhouse—840 Method Rd	6-F	
	36	Greenhouse—Plant Pathology	5-D	PPG
E...	37	Grinnell-Kilgill Health Lab	5-E	GHC
N...T	38	Hatfield Hall	5-D	HA
N...T	39	Harris Hall	5-D	
W...T	40	D H Hill Library—Original Wing	5-C	DHL
W...T	41	D H Hill Library—Book Stack Tower	5-C	
N...S	42	O. H. Hill Library—Erdani-Cloyd Wing	5-C	
N...T	43	North Campus Bookshop	5-D	
N...T	44	Hilborn Building	2-C	
W...	45	Hodges Wood Products Lab	4-E	HWP
	46	Holiday Hall	2-B	
	47	Information Center, Visitor Parking	3-B	
S...E	48	Kilgore Hall	6-D	KI
	49	Laundry/Copy Center	3-C	
	49	Lezar Hall	3-B	LEZ
	50	Lezar Residence Hall	5-E	
S...E	51	Mabe Hall	4-C	MN
S...E	52	E. S. King Village (17 Apt. Bldgs. A-G)	7-F	
S...	53	Memorial Tower	3-A	
S...	54	Melcarci Residence Hall	4-D	
S...	55	Meyns Building	3-C	
E...E	56	Nelson Hall	6-D	N
	57	1911 Building	4-C	

ACCESS	NO.	BUILDING NAME	GRID	CODE
	58	Owen Residence Hall	4-D	PA
E...	59	Page Hall	3-C	PS
W...	60	Park Shops	3-C	PT
S...	61	Patterson Hall	4-C	
E...	62	Peeler Hall	3-B	
	63	Physical Plant Maint. Center	7-E	
	64	Physical Plant Shops (Army)	4-D	
E...	65	Phytotron	5-D	PHY
E...T	66	Poe Hall	3-C	POE
N...	67	Poke Hall	4-C	PW
	68	Power Plant	3-C	
S...	68	Price Music Center	4-D	PMC
W...T	70	Protoplas Hall	3-B	
	71	Print Shop/University Graphics	6-F	
E...	72	Quad Snack Bar	2-C	
E...T	73	Wm. Neal Reynolds Coliseum	3-D	RI
E...	74	Ricks Hall	4-C	RD
N...	75	Rubick Engineering Labs	3-C	
	76	Riddow Stadium	3-D	
E...	77	Robertson Wing, Botany Hall	2-E	
S...T	78	Schaub Food Science Building	4-E	SFS
S...E	79	Scott Hall	5-D	SC
	80	Shawn Hall	4-E	
E...	81	NCBI Bookstore	4-D	
E...	82	Sullivan Residence Hall	6-E	
	83	Syme Residence Hall	2-C	
	84	Television Center	6-F	TVS
E...	85	Thompson Theater/Draft Center	2-C	TT
N...	86	Tompkins Hall	3-B	
	87	Tucker Residence Hall	4-D	
	88	Turlington Residence Hall	4-D	
	88	Turner House	6-C	
S...T	90	University Student Center	3-D	USC
	91	Walla Hall	5-E	
W...	92	Weaver Laboratories	5-E	OSW
	93	Weed Control Laboratories	8-F	
S...E	94	Witch Residence Hall	2-E	
S...E	95	Wilma Hall	5-D	WMS
N...E	96	Winston Hall	4-B	WN
E...	97	Winners Hall	4-C	WI
E...	98	North Residence Hall	3-A	
S...T	99	Caldwell Hall	2-D	
S...T	100	Weagler-Brown Building (CAF)	4-D	
E...T	101	Wood Residence Hall	3-D	
E...T	102	A. M. Fountain Diving Hall	5-E	
E...T	103	Solar Demonstration House	5-F	
E...T	104	Administrative Services Center	6-E	
	105	Research Facility (on Central Campus) (Not Shown)		
	106	Pulsen Hall		
	107	Jordan Hall		
	108	Pulp & Paper Labs		
	109	Student Center Annex		

COURTS AND FIELDS	GRID
A. Bagwell-Becton-Berry Quad	2-C
B. Good-Welch-Syme-Brooks Court	3-C
C. Mary E. Yarrington Court	3-B
D. Court of North Carolina	3-B
E. Gardner Arboretum	4-C
F. University Plaza (Brickyard)	5-C
G. University Student Center Plaza	4-D
H. Turlington-Alexander Court	4-D
I. Tucker-Owen Court	4-D
K. Lee-Sullivan-Bragaw Court	5-E
L. Fraternity Court	7-F
M. E. S. King Village Court	4-F
N. Paul H. Deer Triplex	2-D
O. Miller Fields	4-E
P. Duke Field	4-E
Q. McKinnon Center Court	5-F
R. The Big Area	8-F
S. Tennis Courts	6-E

PARKING LOTS	GRID
Boone Ave. Lot	6-C
Carmichael Lot	3-D
Coliseum Bays	3-D
East Coliseum Lot	2-C
Friendly Drive Lot	6-D
Harris Lot	4-E
Hilborn Building Lots	4-E
Parking Deck	2-C
Rubick Lot	3-C
Sullivan Lots	6-E
West Lot	6-E
Additional West Lot Parking	5-E
Yarrington Lot	3-C
Hilborn Square North	2-A

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