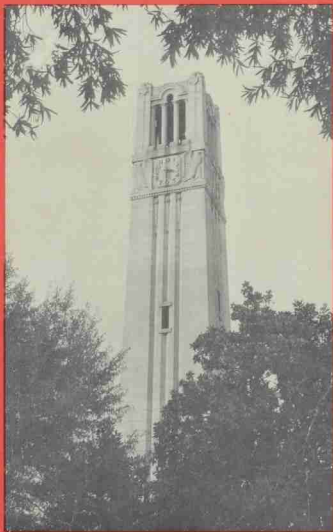


North
Carolina
State University
Bulletin



Undergraduate Catalog
1979-1981

December, 1978

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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Hardy D. Berry, Director, Information Services.



North Carolina State University

Raleigh, North Carolina

Undergraduate Catalog
1979-81

THE UNIVERSITY OF NORTH CAROLINA

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The University of North Carolina was chartered in 1789 and opened its doors to students at its Chapel Hill campus in 1795. Throughout most of its history, it has been governed by a Board of Trustees chosen by the Legislature and presided over by the Governor. During the period 1917-1972, the Board consisted of one hundred elected members and a varying number of *ex officio* members.

By act of the General Assembly of 1931, without change of name, it was merged with The North Carolina College for Women at Greensboro and The North Carolina State College of Agriculture and Engineering at Raleigh to form a multicampus institution designated The University of North Carolina.

In 1963 the General Assembly changed the name of the campus at Chapel Hill to The University of North Carolina at Chapel Hill and that at Greensboro to The University of North Carolina at Greensboro and, in 1965, the name of the campus at Raleigh was changed to North Carolina State University at Raleigh.

Charlotte College was added as The University of North Carolina at Charlotte in 1965, and, in 1969, Asheville-Biltmore College and Wilmington College became The University of North Carolina at Asheville and The University of North Carolina at Wilmington respectively.

A revision of the North Carolina State Constitution adopted in November 1970 included the following: "The General Assembly shall maintain a public system of higher education, comprising The University of North Carolina and such other institutions of higher education as the General Assembly may deem wise. The General Assembly shall provide for the selection of trustees of The University of North Carolina. . . ." In slightly different language, this provision had been in the Constitution since 1868.

On October 30, 1971, the General Assembly in special session merged, without changing their names, the remaining ten state supported senior institutions into the University as follows: Appalachian State University, East Carolina University, Elizabeth City State University, Fayetteville State University, North Carolina Agricultural and Technical State University, North Carolina Central University, North Carolina School of the Arts, Pembroke State University, Western Carolina University, and Winston-Salem State University. This merger, which resulted in a statewide multicampus university of sixteen constituent institutions, became effective on July 1, 1972.

The constitutionally authorized Board of Trustees was designated the Board of Governors, and the number was reduced to thirty-two members elected by the General Assembly, with authority to choose their own chairman and other officers. The Board is "responsible for the general determination, control, supervision, management, and governance of all affairs of the constituent institutions." Each constituent institution, however, has its own board of trustees of thirteen members, eight of whom are appointed by the Board of Governors, four by the Governor, and one of whom, the elected president of the student body, serves *ex officio*. The principal powers of each institutional board are exercised under a delegation from the Board of Governors.

Each institution has its own faculty and student body, and each is headed by a chancellor as its chief administrative officer. Unified general policy and appropriate allocation of function are effected by the Board of Governors and by the President with the assistance of other administrative officers of the University. The General Administration office is located in Chapel Hill.

The chancellors of the constituent institutions are responsible to the President as the chief administrative and executive officer of The University of North Carolina.

North Carolina State University

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Eli D. Panee, *Director*
Residence Life
Charles L. Oglesby, *Director*
Student Health Programs
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G. Robert Armstrong, *General*
Manager, Students Supply Stores
S. C. Schlitzkus, *Director, Auxiliary*
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Foundations and University Rela-
tions
John Kanipe, *Assistant Vice Chan-*
cellor

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Bryce R. Younts, *Director*

Department of Athletics

Willis R. Casey, *Director*



Chancellor Joab Thomas; Tom Hendrickson, president, Student Government; Nick Stratas, president, Student Senate; and Prof. Charles Smallwood, chairman, Faculty Senate.

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Aerial view of a portion of the campus of North Carolina State University.

North Carolina State University

North Carolina State University is one of the nation's major public universities large, complex, national and international in scope, and a leader in scientific research.

It ranks among the top universities in the nation, and shares the distinctive character of Land-Grant state universities nationally broad academic offerings, extensive public service, national and international activities, and large-scale extension and research programs.

Academic excellence is well represented in more than 80 bachelors of arts and science programs, 68 masters degree fields and 46 doctoral degrees.

Research activities span a broad spectrum of about 700 scientific, technological and scholarly endeavors, with a budget of approximately \$25 million annually.

Extension work on a statewide basis in each of the 100 counties underscores the idea that the University's campus extends to the state's boundaries. Diverse extension programs include urban affairs, marine sciences, environmental protection, engineering, industrial, business and textiles, agricultural and many others.

The annual University budget is more than \$120 million. The University has 4,600-plus employees. There are 1,621 faculty and professional staff and 174 adjunct and federal agency faculty, including 1,075 graduate faculty.

There are 120 campus buildings with an estimated value of about \$200 million.

The central campus is 596 acres, though the University has 88,000 acres on a statewide basis, including one research and endowment forest of 78,000 acres. Near the main campus are research farms; biology and ecology sites; genetics, horticulture, and floriculture nurseries; forests, and areas such as Carter Stadium which comprise about 2,500 acres.

The University's Wolfpack athletics teams are well-known nationally. The basketball team was national champion in 1974-75. The football team has been the Atlantic Coast Conference champion four times and co-champion twice and has won three bowl games in the last decade. The Wolfpack is now fielding women's inter-collegiate athletics teams.

North Carolina State University is one of the three Research Triangle Universities along with Duke University and the University of North Carolina at Chapel Hill. In the 30-mile triangle formed by the three universities is the 5,000-acre Research Triangle Park, the Research Triangle Institute, a Universities's subsidiary, and the Triangle Universities Computation Center, a central facility for the extensive computing centers of the institutions.

N. C. State's enrollment reached 18,500 in the 1978 fall semester. There are 13,000 students in undergraduate degree programs, 2,600 in graduate degree programs, and nearly 3,000 special students in various categories. The total student population includes approximately 1,300 black or other minority students, 6,000 female students, and 4,500 students twenty-five years of age or older. Students at State come from 47 states and 80 countries. The international enrollment is a distinctive feature of the institution since its 800 international students give it a decidedly cosmopolitan atmosphere.

NCSU is one of the 140 members of the National Association of State Universities and Land-Grant Colleges. Even though these institutions constitute less than 5

percent of the 2,500 colleges and universities in the nation, they constitute the nation's major institutions. They enroll about 30 percent of all U.S. college students 2.9 million out of 9.7 million, and award 38 percent of all degrees awarded in the United States, including 64 percent of all doctoral degrees.

NONDISCRIMINATION STATEMENT

North Carolina State University is dedicated to equality of opportunity within its community. Accordingly, North Carolina State University 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 handicap. North Carolina State University commits itself to positive action to secure equal opportunity regardless of those characteristics.

North Carolina State University 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, and Executive Order 11246.

For information concerning these provisions, contact:

Affirmative Action Officer
201 Holladay Hall
North Carolina State University
Raleigh, North Carolina 27650

University Calendar

SPRING SEMESTER, 1979

January	8	Mon.	Registration Day
January	9	Tues.	Change Day (Late registration, Drop/Add)
January	10	Wed.	First day of classes
January	17	Wed.	Last day to add a course (to add during second week requires permission of instructor.)
January	24	Wed.	Last day to withdraw (or drop a course) with a refund; Last day for undergraduate student to drop below 12 hours
February	7	Wed.	Last day to drop a course at the 400 level or below without a grade
March	2	Fri.	Mid-semester reports due; Spring vacation begins at 10:00 p.m.
March	12	Mon.	Classes resume at 7:50 a.m.
March	15	Fri.	Last day to drop a course at the 500 or 600 level without a grade
April	16	Mon.	Holiday
April	27	Fri.	Last day of classes
April	30-	Mon.-Sat.	Final examinations
May	9	Mon.-Wed.	
May	12	Sat.	Commencement

SUMMER SESSION, 1979

First Session

May	22	Tues.	Registration Day
May	23	Wed.	First day of classes
May	24	Thurs.	Last day to add a course (to add during third and fourth days requires permission of instructor)
May	28	Mon.	Last day to withdraw (or drop a course) with a refund
June	1	Fri.	Last day to drop a course at the 400 level or below without a grade
June	8	Fri.	Last day to drop a course at the 500 or 600 level without a grade
June	26	Tues.	Last day of classes
June	27	Wed.	Final examinations

Second Session

July	2	Mon.	Registration Day
July	3	Tues.	First day of classes
July	4	Wed.	Holiday
July	5	Thurs.	Last day to add a course (to add during third and fourth days requires permission of instructor)
July	9	Mon.	Last day to withdraw (or drop a course) with a refund
July	13	Fri.	Last day to drop a course at the 400 level or below without a grade
July	20	Fri.	Last day to drop a course at the 500 or 600 level without a grade
August	7	Tues.	Last day of classes
August	8	Wed.	Final examinations

FALL SEMESTER, 1979

August	23	Thurs.	Registration Day
August	21	Fri.	Change Day (Late registration, Drop/Add)
August	27	Mon.	First day of classes
September	3	Mon.	Holiday
September	4	Tues.	Last day to add a course (to add during second week requires permission of instructor)
September	10	Mon.	Last day to withdraw (or drop a course) with a refund; Last day for undergraduate student to drop below 12 hours
September	24	Mon.	Last day to drop a course at the 400 level or below without a grade
October	12	Fri.	Mid-semester reports due; Fall vacation begins at 10:00 p.m.
October	17	Wed.	Classes resume at 7:50 a.m.
October	26	Fri.	Last day to drop a course at the 500 or 600 level without a grade
November	21	Wed.	Thanksgiving vacation begins at 1:00 p.m.
November	26	Mon.	Classes resume at 8:00 a.m.
December	7	Fri.	Last day of classes
December	10-	Mon.-Sat.	Final examinations
December	19	Mon.-Sat.	

SPRING SEMESTER, 1980

January	7	Mon.	Registration Day
January	8	Tues.	Change Day (Late registration, Drop/Add)
January	9	Wed.	First day of classes
January	16	Wed.	Last day to add a course (to add during second week requires permission of instructor)
January	23	Wed.	Last day to withdraw (or drop a course) with a refund; Last day for undergraduate student to drop below 12 hours
February	6	Wed.	Last day to drop a course at the 400 level or below without a grade
February	29	Fri.	Mid-semester reports due; Spring vacation begins at 10:00 p.m.
March	10	Mon.	Classes resume at 7:50 a.m.
March	14	Fri.	Last day to drop a course at the 500 or 600 level without a grade
April	7	Mon.	Holiday
April	25	Fri.	Last day of classes
April	28	Mon.-Sat.	Final examinations
May	7	Mon.-Wed.	
May	10	Sat.	Commencement

SUMMER SESSION, 1980*First Session*

May	20	Tues.	Registration Day
May	21	Wed.	First day of classes
May	22	Thurs.	Last day to add a course (to add during third and fourth days requires permission of instructor)
May	26	Mon.	Last day to withdraw (or drop a course) with a refund
May	30	Fri.	Last day to drop a course at the 400 level or below without a grade

June	6	Fri.	Last day to drop a course at the 500 or 600 level without a grade
June	24	Tues.	Last day of classes
June	25	Wed.	Final examinations

Second Session

June	30	Mon.	Registration Day
July	1	Tues.	First day of classes
July	2	Wed.	Last day to add a course (to add during third and fourth days requires permission of instructor)
July	4	Fri.	Holiday
July	7	Mon.	Last day to withdraw (or drop a course) with a refund
July	11	Fri.	Last day to drop a course at the 400 level or below without a grade
July	18	Fri.	Last day to drop a course at the 500 or 600 level without a grade
August	5	Tues.	Last day of classes
August	6	Wed.	Final examinations

FALL SEMESTER, 1980*

August	21	Thurs.	Registration Day
August	22	Fri.	Change Day (Late registration, Drop/Add)
August	25	Mon.	First day of classes
September	1	Mon.	Holiday
September	2	Tues.	Last day to add a course (to add during second week requires permission of instructor)
September	8	Mon.	Last day to withdraw (or drop a course) with a refund; last day for undergraduate student to drop below 12 hours
September	22	Mon.	Last day to drop a course at the 400 level or below without a grade
October	10	Fri.	Mid-semester reports due; Fall vacation begins at 10:00 p.m.
October	15	Wed.	Classes resume at 7:50 a.m.
October	24	Fri.	Last day to drop a course at the 500 or 600 level without a grade
November	26	Wed.	Thanksgiving vacation begins at 1:00 p.m.
December	1	Mon.	Classes resume at 7:50 a.m.
December	5	Fri.	Last day of classes
December	8-	Mon.-Sat.	Final examinations
December	17	Mon.-Wed.	

*Tentative

Academic Programs

North Carolina State University offers more than 80 fields of study at the undergraduate level. These fields of study include many comprehensive academic programs leading to B.S. or B.A. degrees. Some are options within degree programs, such as the Wildlife Biology Option within the B.S. in Zoology or the Writing-Editing Option within the B.A. in English. The Individualized Study Program in Agriculture and Life Sciences and the Multidisciplinary Studies Program in Humanities and Social Sciences each provide 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 North Carolina State University:

Agriculture

- Agricultural Economics
- Agronomy
- Animal Science
- Biological and Agricultural Engineering
- Crop Science
- Food Science
- Horticultural Science
- Nutrition
- Pest Management for Crop Protection
- Poultry Science
- Soil Science

Business and Economics

- Accounting
- Business Management
- Economics

Biological Sciences

- Biochemistry
- Biological Sciences
- Botany
- Entomology
- Fisheries and Marine Biology
- Microbiology
- Wildlife Biology
- Zoology

Design

- Architecture
- Landscape Architecture
- Product Design
- Visual Design

Education (including teacher certification)

- Agricultural
- English
- French Language and Literature
- Industrial Arts

Mathematics

- Science (biology, chemistry, earth science, & physics)
- Social Studies (economics, history, political science, & sociology)
- Spanish Language and Literature
- Technical
- Vocational Industrial

Engineering

- Aerospace
- Chemical
- Civil
- Construction
- Electrical
- Engineering Operations
- Furniture Manufacturing and Management
- Industrial
- Materials
- Mechanical
- Nuclear

Forestry and Natural Resources

- Conservation
- Forestry

Humanities

- English and American Literature
- French Language and Literature
- History
- Philosophy
- Spanish Language and Literature
- Speech-Communication
- Writing-Editing

Individualized Programs

- Individualized Study Program (Agriculture and Life Sciences)
- Multidisciplinary Studies (Humanities and Social Sciences)

Mathematics and Related Sciences

Applied Mathematics
 Computer Science
 Mathematics
 Statistics

Physical Sciences

Chemistry
 Geology
 Meteorology
 Physics

Medical and Veterinary Sciences

Medical Technology
 Pre-dental
 Pre medical
 Pre-veterinary

Psychology

Experimental Psychology
 Human Resources Development
 Psychology

Recreation

Recreation Resources Administration

Social Sciences

Criminal Justice
 Political Science
 Rural Sociology
 Social Work
 Sociology

Textiles

Textiles
 Textile Chemistry
 Textile Management
 Textile Science

Wood Science

Pulp and Paper Science and Technol
 ogy
 Wood Science and Technology

Agricultural Institute

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:

Agricultural Equipment Technology
 Agricultural Pest Control (Agricultural, Urban and Industrial Options)
 Field Crops Technology
 Flower and Nursery Crops Technology
 Food Processing, Distribution and Service
 General Agriculture
 Livestock Management and Technology (Dairy and Animal Husbandry Options)
 Soil Technology
 Turfgrass Management

UNDERGRADUATE DEGREES AND OPTIONS LEADING TO DEGREES**Bachelor's of:**

Design environmental design in architecture; environmental design in landscape architecture; and environmental design in product design (including option in visual design).

Humanities and Social Sciences

social work.

Bachelor of Science in:*Agriculture and Life Sciences*

(*Business*) agricultural economics

<i>(Science)</i>	agricultural economics; animal science; biological and agricultural engineering; biological sciences (including options in biochemistry, microbiology, and nutrition); botany; conservation; crop science; entomology; food science; horticultural science; medical technology; pest management for crop protection; poultry science; pre-veterinary option; rural sociology (including option in criminal justice); soil science; wildlife biology; and zoology (including options in pre-dental and pre-medical; fisheries and marine biology).
<i>(Technology)</i>	agronomy; animal science; biological and agricultural engineering; food science; horticultural science; and poultry science.
<i>Individualized Study Program in Agriculture and Life Sciences.</i>	
<i>Education</i>	agricultural education; industrial arts education; mathematics education; science education (including biology, chemistry, earth science, and physics); technical education; and vocational industrial education.
<i>Engineering</i>	aerospace engineering; biological and agricultural engineering; chemical engineering; civil engineering; construction option; electrical engineering; engineering operations; furniture manufacturing and management; industrial engineering; materials engineering; mechanical engineering; and nuclear engineering.
<i>Forest Resources</i>	conservation; forestry; pulp and paper science and technology; recreation resources administration; and wood science and technology.
<i>Humanities and Social Sciences</i>	economics; English; history; philosophy; and political science.
<i>Physical and Mathematical Sciences</i>	chemistry; computer science; geology; mathematics; meteorology; physics; and statistics.
<i>Textiles</i>	textiles; textile chemistry; textile management; textile science

Bachelor of Arts in:

<i>Education</i>	psychology (including options in experimental; human resource development).
<i>Humanities and Social Sciences</i>	accounting; business management; economics; English (including options in teacher education; writing-editing); French (including option in teacher education); history; multi-disciplinary major in humanities and social sciences; philosophy; political science (including option in criminal justice); social studies education option (in economics, history, politics, or sociology); sociology (including option in criminal justice);

Spanish (including option in teacher education); and speech-communication.

Physical and Mathematical Sciences
chemistry; geology.

Professional degrees (fifth year) in:

chemical engineering; civil engineering; electrical engineering; industrial engineering; materials engineering; mechanical engineering; and nuclear engineering.

GRADUATE DEGREES

Master's of:

adult and community college education, agricultural education, agriculture, architecture, biological and agricultural engineering, biomathematics, chemical engineering, civil engineering, computer studies, curriculum and instruction, economics, educational administration and supervision, electrical engineering, engineering (off-campus program), forestry, guidance and personnel services, industrial arts education, industrial engineering, landscape architecture, life sciences, mathematics education, mechanical engineering, occupational education, product design, public affairs, recreation resources, sociology, science education, special education, statistics, technology for international development, textiles, urban design, vocational industrial education, wildlife biology, wood and paper science.

Master of Arts in:

economics, English, history, and political science.

Master of Science in:

adult and community college education, agricultural economics, agricultural education, animal science, applied mathematics, biochemistry, biological and agricultural engineering, biomathematics, botany, chemical engineering, chemistry, civil engineering, computer studies, crop science, curriculum and instruction, ecology, educational administration and supervision, electrical engineering, entomology, food science, forestry, genetics, geology, guidance and personnel services, horticultural science, industrial arts education, industrial engineering, management, marine sciences, materials engineering, mathematics, mathematics education, mechanical engineering, meteorology, microbiology, nuclear engineering, nutrition, occupational education, operations research, physics, physiology, plant pathology, poultry science, psychology,

recreation resources administration, rural sociology, science education, soil science, special education, statistics, textile chemistry, textiles, vocational industrial education, wildlife biology, wood and paper science, and zoology.

Doctor of Philosophy in:

animal science, applied mathematics, biochemistry, biological and agricultural engineering, biomathematics, botany, chemical engineering, chemistry, civil engineering, crop science, economics, electrical engineering, entomology, fiber and polymer science, food science, forestry, genetics, horticultural science, industrial engineering, marine sciences, materials engineering, mathematics, mathematics education, mechanical engineering, microbiology, nuclear engineering, nutrition, operations research, physics, physiology, plant pathology, psychology, science education, sociology, soil science, statistics, 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, industrial arts education, and occupational education.

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

HONORS PROGRAMS

Honors Programs are designed to provide individualized programs of study for promising young scholars. The Schools of Agriculture and Life Sciences, Engineering, Forest Resources, Humanities and Social Sciences, Physical and Mathematical Sciences, and Textiles have separate plans built around honors courses, supervised research, and special seminars. Students who demonstrate exceptional ability and achievement during their freshman or sophomore year are eligible to participate. Information is available from faculty advisers and from the office of the dean of each school.

COOPERATIVE EDUCATION PROGRAMS

Cooperative Education Programs are offered in the Schools of Engineering, Forest Resources, Humanities and Social Sciences, Physical and Mathematical Sciences, and Textiles. These programs are designed to provide students alternating semesters of study and full-time work experience in their chosen fields. This normally takes place during the sophomore and junior levels and means that attaining a degree will take more than the usual eight semesters. A grade point average of 2.25 is required for students entering this program, and transfers must first complete at least one semester at NCSU. To remain in the program, students

must maintain a cumulative average of 2.00, arrange for a minimum of 12 months of work experience, and be registered for each work period with the respective co-op course numbers for their school. Students who are considering participation in a co-op program should obtain further information from their faculty advisers or from the coordinator of the program for their school.

EVENING UNDERGRADUATE DEGREE PROGRAMS

The School of Humanities and Social Sciences now offers complete undergraduate degree programs during the evening hours for adult, part-time students. Such degree programs are available in the departments of Economics and Business, English, History, Sociology and Anthropology, Foreign Languages and Literatures, and Political Science. Persons interested in more information about these evening degree programs should contact the N.C.S.U. Division of Continuing Education, P.O. Box 5125, Raleigh, N.C. 27650; (919) 737-2265.

Special Programs

The University has numerous special programs designed to meet the interests and needs of individual students including the following:

Alexander International Program. The International Program in Alexander Residence Hall involves American and foreign students in a program designed to facilitate cross-cultural understanding and to increase the participants' knowledge of world affairs. Students in Alexander can expand their appreciation and knowledge of other cultures and other people and can learn more about themselves by living with students from many different countries. Dinner seminars, parties, films, speakers, credit courses, and special programs focus on international themes and issues. Two Alexander residents are awarded foreign study scholarships for travel and study abroad each summer.

Learning Opportunities Unlimited. Learning Opportunities Unlimited (LOU) is a program of non-credit interest courses offered by the Department of Residence Life. The courses are usually taught in residence hall lounges and recreation rooms and cover such topics as karate, auto mechanics, social dancing, ballet, meditation, photography, women's self defense, and tap dancing.

Metcalf Living-Learning Program. The Living-Learning Program in Metcalf Residence Hall is primarily designed for freshmen who are interested in educational and cultural development. The program involves male and female freshmen in all eight schools of the University, although those in the School of Humanities and Social Sciences who are interested in a special residential program are encouraged to first consider the Transition Program.

Metcalf students can take several courses together in cluster classes, become informally acquainted with faculty members, hear outside speakers, and participate in planned discussions. Faculty members and graduate students provide tutorials to assist the freshmen with their courses.

Friends of Adam Smith. Friends of Adam Smith is a program coordinated by the Department of Economics and Business and the Department of Residence Life which involves 35 to 40 sophomores majoring in accounting, business management,

or economics. These students live in Lee and Sullivan Residence Halls and take several classes together each semester, which are taught in the Cultural Center nearby. A study lounge with tape calculators, reference books, and other resource materials related to the courses is available in Sullivan Hall for program participants.

The program is coordinated by a graduate student from the Department of Economics and Business, and two seniors majoring in the department are hired to live in the halls and to provide tutoring, advising, and other assistance related to the academic course work. Visiting business executives, accountants, economists, government officials, etc., meet with the participants in class and in informal dinners and discussion groups in the evenings. Other activities available for students in this program include a special career planning workshop, field trips to businesses in the area, and programs related to the students' course work and career objectives.

National Student Exchange Program. North Carolina State is one of 42 state supported colleges and universities belonging to the National Student Exchange Program. Each year an opportunity is provided for 25 State students to study at one of the other participating schools and still pay the same tuition and fees they pay here. Much red tape normally associated with a change of school is also avoided. Eligible students must be in either sophomore or junior year, have 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 Office of Student Development, 214 Harris Hall.

North Carolina Fellows Program. North Carolina State University offers a unique learning and development experience known as the North Carolina 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 fifteen 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.

PASS (Program of Academic Support Services). The Department of Residence Life provides several academic support services for students living in the residence halls under the Program of Academic Support Services (PASS). These include weekly tutorials in chemistry, math, physics, and English in each residence hall area; study skills classes and workshops on topics such as test anxiety reduction, study skills, reading improvement, term paper writing, and career planning; special facilities such as the computer facility in Bragaw Hall; and the Freshman Adviser Program. Freshman advisers are upperclassmen living in the residence halls who volunteer to assist several freshmen in their major who live in the same or a nearby residence hall.

Transition Program. The Transition Program involves 60 male and female freshmen who live in the Berry-Becton-Bagwell Quad and take four courses together - American history, American literature, philosophy, and a special colloquium. The courses are taught as an interdisciplinary approach to American Civilization and are supplemented with a variety of films, guest speakers, field

trips, dramatic productions, and special projects. In addition to this course cluster, Transition participants enroll in other regular University courses, normally science, math or foreign language, and physical education.

The Transition courses are taught in the Berry Residence Hall lounge and one of the faculty members lives in an apartment in the Quad. The faculty members have an office in Berry Hall, and the nature of the program encourages very informal relationships between students and faculty. Transition is designed primarily for freshmen in the School of Humanities and Social Sciences, but interested students in other schools are encouraged to apply and will be selected as space permits.

Summer Study at Oxford, England. A cooperative program with the University of North Carolina at Asheville that offers North Carolina State University students a four-week summer experience at Oxford, England. Program is limited to 35 participants and students may take one or two courses. Academic credit is granted for this work by NCSU. Courses include Shakespeare, British History, Contemporary British Novel, Town Planning, and Contemporary Philosophy. All courses are taught by British scholars. Ample time is made available for independent travel in order to maximize the British experience. Contact the Division of Student Affairs for full details, Room 214 Harris Hall.

Admissions

Freshman applications to the University for the fall semester or summer sessions should be submitted during the fall of the senior year in high school. Based on past experience, applications and credentials received in the fall and early winter have received full consideration while those applications received later have been (and may be again) subject to a waiting list, depending upon space availability. Those students whose applications are placed on a waiting list will be notified of their final status by June 1.

Applicants for the School of Design should submit applications by January 1. Applications for the spring semester should be submitted prior to December 1, however, all acceptances for the spring semester are subject to space availability.

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

Director of Admissions
P. O. Box 5126
North Carolina State University
Raleigh, North Carolina 27650

A nonrefundable \$10 fee must accompany the completed application.

FRESHMAN ADMISSION

Applicants normally should be graduates of an accredited high school and have the recommendation of the principal or counselor. Non-graduates should usually have a high school equivalency certificate, the minimum high school mathematics preparation, and present other evidence of maturity and ability to deal effectively with college work.

Prospective students should have the following high school credits (courses):

English 4 years

History 2 years

Mathematics 2 years of algebra; 1 year of geometry; advanced algebra and trigonometry is strongly recommended for schools of Engineering, Forest Resources, and Physical and Mathematical Sciences

Science 2 years, preferably biology, chemistry, or physics

Foreign Language 2 years recommended for School of Humanities and Social Sciences only

Information the University needs for admissions purposes includes: the high school record showing grades through the junior year, a listing of courses in progress in the senior year, an overall grade point average based on at least three years of high school study, scores on the Scholastic Aptitude Test (SAT) or ACT, and the field of study of curriculum preferred.

In addition to adequate high school preparation, each freshman must meet a minimum Predicted Grade Average computed on the basis of the high school grade point average and scores on the SAT or ACT. The grade point average carries greater weight in the prediction than the test scores.

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. An interview is not required and does not weigh in the admissions decision; however, a prospective student is always welcome to visit the Admissions Office, 112 Peele Hall, from 8:00 a.m. until 5:00 p.m. Monday through Friday.

Two-Year Agricultural Institute

Requirements for admission to the Agricultural Institute, a two-year terminal program, include graduation from an accredited high school or successful completion of the high school equivalency examination administered by the State Department of Public Instruction. The application should include 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 Institute Director. SAT scores are not required.

Freshman Profile

Who makes up the student body of NCSU? Sixty-six percent of the freshmen who entered in August 1977, had a high school grade point average of 3.0 or higher and ninety-five percent had a high school grade point average of 2.5 or better. High school performance is usually considered the best predictor of success in college; however, if you have a lower grade point average but did well on the SAT you should not be discouraged from applying for admission. In 1977-78, the freshman class at State had average SAT scores of 462 Verbal and 535 Mathematics.

Scholastic Aptitude Test (SAT), American College Testing Program Achievement Tests, Advanced Placement

Scholastic Aptitude Test and American College Test—Applicants for admission as freshmen must take the College Entrance Examination Board Scholastic Apti-

tude Test (SAT) or the American College Test (ACT) and request that their scores be sent directly from the Board to North Carolina State University (Code No. R5496). Information booklets and application forms may be obtained from school counselors or by writing:

College Entrance Examination Board
Box 592
Princeton, New Jersey 08540

or

American College Testing Program
P. O. Box 414
Iowa City, Iowa 52240

Achievement Tests—Achievement Test scores are not used in the admissions decision; however, freshmen who take the English and Math Level I Achievement Tests will receive more accurate placement in the beginning English and math courses. The fall and winter test dates are considered the best time for taking these tests.

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; 2) by attaining a sufficient predicted grade in English (PGE) which is based on the SAT Verbal score and either the high school record or the CEEB English Achievement score; 3) by attaining a sufficient predicted grade in mathematics (PGM) which is based on the SAT Mathematics score and either the high school record or the CEEB Mathematics Achievement score; 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 on certain of the College Level Examination Program (CLEP) subject tests.

OUT-OF-STATE STUDENTS

Undergraduate applicants from outside North Carolina must meet higher standards than required of N. C. residents in some fields of study before admission will be granted. North Carolina State University is limited to accepting not more than 15 percent of total undergraduate admissions from outside the State.

TRANSFER STUDENTS

North Carolina State University welcomes transfer applicants, and in recent years, more than 25 percent of our graduates started their college programs at other institutions.

Transfer applicants should present at least 28 semester hours of "C" or better college-level work with a minimum overall 2.0 average on all work attempted and be eligible to return to the last institution regularly attended. Programs that are experiencing space limitations may require a higher minimum grade point average for admission. Students presenting less than 28 semester hours must also meet the admissions requirements for entering freshmen. Applications of students from non-accredited institutions are reviewed by the Admissions Committee.

Work completed at technical institutes is generally not considered college level; however, students from such institutes may take comprehensive examinations in

courses in which they feel previous training qualifies them for advanced placement.

If admitted, the prospective transfer student's record will be further evaluated by the school in which the student wishes to enroll to determine the amount of credit that can be transferred and applied toward degree requirements at N.C. State. *Transcripts are not evaluated however until the applicant has been admitted.* A nonrefundable \$2 transcript evaluation fee, payable to North Carolina State University, is charged for this service.

ADDITIONAL CLASSIFICATIONS

Unclassified Students An unclassified student is one who has been approved for admission to a specific school and is earning college credit but has not chosen a specific curriculum. He or she must meet the same admissions requirements as regular students. If, at a later date, an unclassified student wishes to change to regular status, credits must be evaluated for his or her chosen curriculum.

Special Students The special student classification is primarily designed for students 18 years of age or older who are employed in the Raleigh area, including homemakers and other mature individuals interested in college courses for special reasons, but who do not desire to work toward a degree at North Carolina State University. The usual college admissions requirements may be waived for qualified special students, but regular rules of scholarship apply after admission.

Special student applications should be made through the Division of Continuing Education, McKimmon Extension Education Center, corner of Western Boulevard and Gorman Street. If special students wish to change to regular status at a later date, they must make regular application through the Admissions Department and meet the same admissions requirements as other degree candidates.

SERVICEMEN'S OPPORTUNITY COLLEGES, COLLEGE LEVEL EXAMINATION PROGRAM

Servicemen's Opportunity Colleges (SOC) College level courses offered by accredited institutions and made available to military personnel through SOC will be considered for transfer credit if a grade of "C" or better has been earned and if the courses are applicable to the student's curriculum. A transcript must be sent to the Director of Admissions directly from the institution offering the course.

College Level Examination Program—CLEP primarily serves non-traditional students who have acquired knowledge through University extension courses, educational television, non-credit adult education programs, on-the-job training, and independent study by enabling them to demonstrate their knowledge and receive college credit on the basis of examinations.

There are two types of examinations, General Examinations and the Subject Examinations. Although only a limited amount of credit is given for the General Examinations, many Subject Examinations are accepted for credit. The examinations are given at N. C. State during the third week of each month, and candidates should register three weeks before the test date.

For further information write or telephone the Counseling Center, North Carolina State University, Box 5072, 200 Harris Hall, Raleigh, N.C. 27650; (919) 737-2423.

GRADUATE STUDENTS

Procedures and policies governing graduate admission are outlined in a special catalog issued by the Graduate School. For a copy of the Graduate School catalog contact:

Dean of the Graduate School
104 Peele Hall
North Carolina State University
Raleigh, North Carolina 27650

Registration

Preregistration: To preregister a student meets with his or her adviser to discuss an academic program and to select courses for the next semester. The courses selected by each student are processed through the computer which assigns a day and an hour for each course requested. During the registration period at the beginning of each semester, the student obtains a completed class schedule. Schedule of Courses listings are available for every semester and they contain all necessary instructions for completing preregistration. To be preregistered, a student must submit a Preregistration Schedule Request form to Registration and Records during the specified preregistration period.

Registration: Registration consists of three steps: 1) paying tuition and fees preferably by mail, 2) completing registration forms, and 3) obtaining class schedules. Students who register late must follow late registration instructions and pay the required late fees. Instructions for completing registration and late registration are issued each semester and summer session. Each student is expected to complete registration in person. Under no circumstances is a preregistered student considered officially registered until such time as the student has picked up a class schedule and completed the registration forms.

INTERINSTITUTIONAL REGISTRATION

A regularly enrolled undergraduate degree student who is enrolled in at least eight credit hours at North Carolina State University may take 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. Inter-institutional registration forms and all registration procedures are available from Registration and Records.

SCHEDULE CHANGES—DROPS AND ADDS

Courses may be added freely during the first week of a regular semester and during the second week with the permission of the instructor. All courses may be dropped freely without regard to course load during the first two weeks of a regular semester. Courses may be freely dropped during the first four weeks of a semester except that during the third and fourth week of a semester, full-time undergraduate students who wish to drop courses and whose academic load would thereby fall below the twelve hour minimum course load may do so only with the approval by the dean of the student's school. After the fourth week of classes no

courses may be dropped without the approval by the dean of the student's school. If a student wishes to drop all courses for which he is enrolled, the procedure is that of withdrawal from the University.

Tuition and Fees

North Carolina Resident \$279.15 per semester (\$182 tuition plus \$97.15 fees).
 Nonresident \$1,135.15 per semester (\$1,038 tuition plus \$97.15 fees).

A statement of tuition and fees is mailed to each preregistered student around 25-30 days 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 approximately one week before classes begin. Fees are the same for both residents and nonresidents and are required of all regularly enrolled students. Nonresident students are required to pay an additional \$856 per semester for tuition. Non-preregistered students are required to pay their tuition and fees at registration.

ESTIMATED ANNUAL UNDERGRADUATE EXPENSES

<i>Tuition and Fees</i>	<i>First Semester</i>	<i>Second Semester</i>	<i>Year</i>
(a) N.C. Resident	\$ 279.15	\$ 279.15	\$ 558.30
(b) Out-of-State Residents	1,135.15	1,135.15	2,270.30
Room Rent	235.00	235.00	470.00
Meals	500.00	500.00	1,000.00
Books and Supplies	112.50	112.50	225.00
Other personal expenses and incidentals	225.00	225.00	450.00
TOTAL			
(a) N.C. Residents	\$1,351.65	\$1,351.65	\$2,703.30
(b) Out-of-State Residents	\$2,207.65	\$2,207.65	\$4,415.30

NOTE: All charges are subject to change without notice.

EXPENSES OTHER THAN TUITION AND FEES

Application Fee: A non-refundable fee of \$10 must accompany each application for admission. Transfer students must pay an additional \$2 (\$12 total) as a transcript evaluation fee.

Room Rent: New incoming students receive a room application card with payment instructions in the letter of acceptance. Continuing students are provided a card with instructions at their residence hall rooms. The charge for room rent is \$235 per semester.

Meals: Meals are paid for individually at the various dining facilities available both on and near the campus. A reasonable estimate for this expense is \$500 per semester.

Books and Supplies: Books and supplies are usually purchased during the first week of classes directly from the Students Supply Stores. Allow approximately \$112.50 per semester for purchasing books and supplies.

Personal Expenses: Personal expenses vary widely among students but the estimate of \$225 is based on what students tell us they spend on these items.

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 registration fee. The withheld registration fee amounts to \$15 the first week and \$25 the second week. 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 Refund and Fees Committee when they feel special consideration is merited. Applications for such appeals may be obtained from the Office of Business Affairs or the Division of Student Affairs.

REQUIRED FEES

Required fees are levied for services, facilities, and programs available to all students whether or not the student takes advantage of them. The fees are charged regardless of the number of credit hours for which the student may enroll. An itemization of required fees and other detailed information concerning expenses or related data can be obtained by contacting the Office of Business Affairs, P. O. Box 5067, Raleigh, North Carolina 27650, phone: 919 737-2986.

RESIDENCE STATUS

Until May of 1973, determination of a student's residence status for tuition purposes rested upon the easily administered statutory requirement that "a legal resident must have maintained his domicile in North Carolina for at least 12 months *next preceding the date of enrollment or re enrollment* in an institution of higher education in this State," with the express proviso that "student status in an institution of higher learning in this State shall not constitute eligibility for residence to qualify said student for in-state tuition" (G.S. 116-143.1, 1971) (emphasis added). The administrative consequence of this law was to make necessary, in most cases, only one inquiry concerning residence status for each student, at the outset of the higher education experience, since time spent enrolled as a student could not be counted in satisfaction of the 12-month eligibility requirement.

The 1973 Session of the General Assembly amended the applicable law, so as to read in pertinent part as follows:

"(b) To qualify for in state tuition a legal resident must have maintained his domicile in North Carolina for at least the 12 months immediately prior to his classification as a resident for tuition purposes. In order to be eligible for such classification, the individual must establish that his or her presence in the State during such 12 month period was for purposes of maintaining a bona fide domicile rather than for purposes of merely temporary residence incident to enrollment in an institution of higher education; further, (1) if the parents (or court-appointed legal guardian) of the individual seeking resident classification are (is) bona fide

domiciliaries of this State, this fact shall be prima facie evidence of domiciliary status of the individual applicant and, (2) if such parents or guardian are not bona fide domiciliaries of this State, this fact shall be prima facie evidence of nondomiciliary status of the individual." (University regulations concerning the classification of students by residence, for purposes of applicable tuition differentials, are set forth in detail in *A Manual to Assist The Public Higher Education Institutions of North Carolina in the Matter of Student Residence Classification for Tuition Purposes*. Each enrolled student is responsible for knowing the contents of that *Manual*, which is the controlling administrative statement of policy on this subject. Copies of the *Manual* are available for review on request at the Admissions Office, 112 Peele Hall, North Carolina State University.)

The essential change effected by the 1973 amendment to this statute is that a person who is an enrolled student is no longer necessarily precluded from demonstrating during the period of one's enrollment that he or she in fact has become a legal resident of North Carolina entitled to the in state tuition rate. The administrative consequences of this modification of the law are substantial. Two inquiries are mandated by the statute. First, has the applicant for classification as a legal resident in fact resided in North Carolina for a minimum period of 12 months immediately prior to the proposed effective date of his or her classification as a resident for tuition purposes? Second, during the 12-month period in question, did the applicant's presence in the State constitute legal residence? Thus, a carefully detailed inquiry must be made in each such case concerning the residential status of the applicant, as measured by established legal principles which control the disposition of questions about the place of legal residence of an individual.

CLASSIFICATION PROCEDURES

A. Initial Classification 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) shall be classified by the admitting institution either as a resident or as a nonresident, for tuition purposes, prior to actual matriculation. Particular officials or offices of the institution shall be designated to evaluate all such initial classification cases and to assign an appropriate classification consistent with the requirements of State law and the provisions of this manual. Basic data on which such assignment shall be based shall be collected in accordance with the common informational form prescribed herein (see Appendix B of Residence *Manual*, 1973, as revised 7/74 and 7/75, NCSU); additional data or documentation deemed essential to a reliable determination may be elicited from the student, as deemed appropriate by the responsible official or office.

B. Subsequent Classification Inquiries: Reclassification A residential classification once assigned (and confirmed pursuant to any appellate process invoked) may be changed thereafter only at intervals corresponding with the established primary divisions of the academic calendar of the institution, viz., at the beginning of a semester, quarter, or otherwise denominated basic interval of the academic calendar. No change in residential status for tuition purposes (and thus no change in applicable billing rates) shall be effected during such a semester, quarter, or term, with resulting increases or decreases in the tuition obligation on a pro rata basis for a portion of such semester, quarter, or term.

The institution shall provide to each student at the time of and in connection with the transmission to him or her of each periodic bill for tuition charges a notice of the circumstances under which and the time at which a change in classification may occur. The notice shall be of the type prescribed in Appendix C of the Residence *Manual*, July 1973, as revised 7/74 and 7/75, NCSU.

Financial Aid

In order to be considered for all forms of aid administered by the Financial Aid Office, a student and his parents must complete and mail for calculation purposes the Financial Aid Form (FAF). The form is available from both the high school guidance counselors and from the N. C. State University Financial Aid Office. *All undergraduate students* must indicate on the FAF that they wish consideration for the Basic Educational Opportunity Grant. This is done automatically at no additional charge if the appropriate Basic Grant items are marked on the FAF. The FAF should be completed preferably by February 1 of the year prior to fall semester enrollment and by October 1 of the year prior to spring semester enrollment. Transfers and continuing students should check with the Financial Aid Office regarding any other file information which may be needed for aid consideration. New freshmen who are N.C. residents should also inquire about application procedures for the N.C. Student Incentive Grant. Information about this program is available from both the high school counselors and from the Financial Aid Office.

Awards are made to applicants on the basis of financial need and admission to the University. 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 as well as the student's summer savings, size of family, number of children in post-high school institutions, family asset holdings and debts, and other resources that may be available for use such as G.I. Bill benefits, Social Security, 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 or grant, loan, and/or a work-study award, depending upon the degree of need. Continuing students must have a satisfactory record of academic progress in order to have their aid renewed, and a new application must be submitted each year for continued aid.

SCHOLARSHIPS

Each financial aid applicant who submits the FAF is automatically considered for any scholarship for which he or she is eligible. Some special "name" scholarships have curricular, geographic, or other special restrictions involved.

GRANTS

Basic Educational Opportunity Grant (for which all students who have never received a bachelor's degree must apply) will provide awards ranging from \$176 to \$1,600 to qualified students. Eligibility for a Basic Grant is determined by the Federal Government.

Supplemental Educational Opportunity Grants are made from federal funds to undergraduate students from low-income families in amounts of \$200 to \$1,500 per year. They are especially useful in encouraging promising new students who demonstrate exceptional need. These grants are determined by the University Financial Aid Office.

Minority Incentive Grants are available to black students in their first enrollment at N.C. State University, either as freshmen or as first year graduate students.

N. C. Student Incentive Grant program provides need-based grants for legal residents of North Carolina. Entering freshmen and students who have received the grant before have priority for future grants. Grants range up to \$1,500 per academic year.

ATHLETIC AWARDS

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

National Direct Student Loans—Both undergraduate and graduate students carrying at least half-time academic loads may be awarded these loans. Loans, like other forms of financial aid, are need-based. Nine months after ceasing to be enrolled at least half-time, a student must begin paying interest on his or her loan at 3% 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 loan office in the Office of Business Affairs 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 loans made therefrom are on essentially the same liberal terms as the National Direct Student Loans.

Guaranteed Student Loans—These are federal loans provided through banks and private lenders in the various states. Interest is at 7% per year with the Federal Government paying the interest during the in-school period for students who qualify for the interest benefit. In North Carolina, College Foundation, Inc. administers the program. Information and forms are available in the Financial Aid Office.

Emergency Short-Term Loans These loans are available in small amounts (usually not exceeding \$100) to enable any full-time enrolled student 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

The federally supported 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. Pay rates vary with the job. Similar off-campus programs, mainly in the summer, supplement the campus program as a part of the total Work-Study plan.

OTHER STUDENT EMPLOYMENT

The Financial Aid Office operates an employment service to assist any student who wants possibilities for 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 list of current job openings is available at the Financial Aid Office in Peele Hall.

A brochure which gives a detailed explanation of the aid application and award process and the types of aid available may be obtained upon request from the N.C. State University Financial Aid Office.

Student Housing

North Carolina State University furnishes housing for approximately 6,354 students. The University operates residence halls which house 3,705 men and 1,789 women students. In addition, 300 apartments are available for married students and 14 University-owned fraternity and sorority houses accommodate 560 students.

RESIDENCE HALLS

The residence halls are operated to provide opportunities through a variety of group living experiences which will complement and expand the residents' educational experiences. Each hall is staffed with selected students, both graduate and undergraduate, who are responsible directly to professionally trained people in their area and to the Director of Residence Life. Staff members are available to help students initiate programs and activities and to advise and assist residents in any way possible.

Living arrangements in buildings vary. Six high-rise buildings are arranged in suites of four or five rooms sharing a bath; the other buildings have a center corridor with rooms opening on to it. Rooms are furnished but residents must provide bed linen, pillows and towels. (See page 34 for linen and blanket rental.)

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).

Room Rentals and Reservations All rooms rent for \$245 per semester; this rate is subject to change on a year to year basis. Reservation cards are mailed with the letter of acceptance for admission to the University. These reservation cards and the check for the rent should be returned to the Office of Business Affairs immediately since room assignment priority is based on date of payment.

Refund of Room Rent If a room reservation is cancelled at the Office of Residence Life, Harris Hall, in person or in writing on or before August 1 (the date of cancellation is the date notification is received by that office), the rent paid will be refunded less a \$15 processing fee. After August 1, a refund will be given only if there is a waiting list of room applicants from which the vacated space can be filled. A refund given after August 1 will be the rental fee paid less a \$35 processing fee and a prorated daily charge from the first day of classes until the room is vacated. Students who fail to notify the Residence Life Office and who fail to check in and secure their keys on or before 5 p.m. on registration day will have their reservation cancelled without refund.

HOUSING FOR MARRIED STUDENTS

The University operates 300 apartments in E. S. King Village for married students. The rental is \$73 for a studio, \$80 for a one-bedroom, and \$97 for a two-bedroom including water only (gas is included in efficiency units). This rate is subject to change on a year to year basis. Information on availability and applications should be requested from the Department of Residence Life, Box 5072, Raleigh, N.C. 27650

OFF-CAMPUS HOUSING

Raleigh has numerous privately owned apartments and houses available for rent to University students. A partial listing is located in the Department of Student Development in Harris 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

Nineteen of the 22 fraternities and three of the five social sororities chartered by the University maintain chapter houses. Twelve of the fraternities and two of the sororities are housed on Fraternity Row, a University-owned project; the remaining fraternities and sororities are located throughout the immediate community.

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

Academic Regulations

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)	Less than 28
Sophomore (SO)	28 or more, but less than 60
Junior (JR)	60 or more, but less than 92
Senior (SR)	92 or more

Agricultural Institute students are designated as first (01) year if they have earned less 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 dean's recommendation in 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.

Undergraduate Special (UGS) is the classification used for students who have not been admitted to N.C. State and who have not obtained a baccalaureate degree but who wish to enroll in credit courses offered by N.C. State. To be eligible for Undergraduate Special status students must be adults who have acquired a high school diploma or be high school students who have been recommended by their school and approved by the Department of Admissions to take lower level courses. Students who have been suspended from any college or university, including N.C. State, within the last three years or who are degree candidates at N.C. State are not eligible. Undergraduate Special students may register for most courses offered in the regular semesters and summer sessions, provided they have the required prerequisites and provided there is space available. For most practicum and individual special topics or special problems courses as well as internships and research courses the consent of the offering department is required. Undergraduate Special students may not register for more than nine credit hours a semester, and their eligibility to continue from semester to semester will be based on the same academic requirements as regular degree students. Eligibility to study as an Undergraduate Special student does not imply admission to N.C. State.

Post-baccalaureate Studies (PBS) is the classification used for students who have received a baccalaureate from an accredited institution and who have not been admitted to an undergraduate or graduate degree program at N.C. State but who wish to enroll in credit courses offered by N.C. State. PBS students who have any intention of subsequently applying for admission to a graduate program at N.C. State should familiarize themselves with the policies and procedures of The Graduate School as outlined in the Graduate Catalog. The PBS classification carries with it no implication that PBS students will be admitted to The Graduate School in any degree classification.

SEMESTER COURSE LOAD AND SPECIAL REQUIREMENTS

The University considers a minimum full-time semester load as 12 credit hours for undergraduates and 9 credit hours for graduate students. The maximum load for a semester is 21 credit hours for undergraduates and 15 credit hours for graduate students. To carry more than the maximum, a student must consult his or her adviser and obtain the approval of the dean of his or her school.

Permission is granted only under extenuating circumstances. Also, undergraduate degree students who plan to register for 19 or more credit hours must obtain approval from their adviser.

For a regular summer session, a student must have the same approval if he or she carries more than seven credit hours.

NOTE: The number of hours for which a student is officially enrolled is that number for which the student is enrolled 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

(Definition of Letter Grades and Grade Points)

<i>Grade</i>	<i>Definition</i>	<i>Grade Points Per Credit Hour</i>
A	Excellent	4
B	Good	3
C	Satisfactory	2
D	Marginal	1
NC	No Credit	0

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

<i>S</i>	Satisfactory (Credit-only and certain other courses)
<i>U</i>	Unsatisfactory (Credit-only and certain other courses)
<i>CS</i>	Satisfactory (for certain PBS students only)
<i>CU</i>	Unsatisfactory (for certain PBS students only)
<i>CR</i>	Credit by Examination or Advanced Placement
<i>IN</i>	Incomplete
<i>LA</i>	Temporarily Late
<i>AU</i>	Audit
<i>NR</i>	No Recognition Given for Audit

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 NC. (See section on graduation requirements for policy on limiting the number of credits which may be used to fulfill graduation requirements.)

NC No Credit. This grade will be used to indicate that the student is not to receive course credit.

S Satisfactory. This is a passing grade to be awarded only when the quality of the student's work is judged to be C or higher level. It is used as the passing grade for students who are taking free elective courses under the credit-only option. It may also be used for certain courses such as orientation courses, seminars, and research problems, in which A, B, and C grades are not appropriate.

U Unsatisfactory. This 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*).

CS Satisfactory. This is a passing grade awarded to a PBS student taking a 500 or 600 level course after that student has received 9 hours of letter grade credit in 500 or 600 level courses and when the quality of the student's work is judged to be of C or higher level.

CU Unsatisfactory. This is used to indicate that a PBS student is not to receive credit for a course for which the passing grade would be CS (*Satisfactory*).

CR Credit. This 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, a student may be given an IN grade for work not completed because of a serious interruption in his work not caused by his own negligence. An IN grade must be made up by the last day of classes of the next regular semester (not including summer sessions) the student is in residence unless the instructor or teaching department involved is not able to allow the makeup. In the latter case, the instructor or teaching department will notify the student and the Department of Registration and Records when the IN grade must be made up.

The student must not register again for the course while the IN grade stands. Any IN grade not removed by the last day of classes of the next regular semester in residence or during the period specified by the instructor or teaching department will automatically become a NO CREDIT (NC) grade and will count as a course attempted.

NOTE: In the case of a graduating student who has received an IN, the following procedures will apply:

If the course IS needed for graduation, the student will not be allowed to graduate until the work has been made up.

If the course is NOT needed for graduation, the school dean or director of instruction must either (1) notify in writing the Department of Registration and Records that the IN grade is to be deleted or (2) notify in writing the Department of Registration and Records that permission has been given for the IN to remain and that a deadline has been established for the completion of the course. In the event that the course is subsequently not completed satisfactorily, the school dean or director of instruction shall notify in writing the Department of Registration and Records that the IN grade is to be deleted.

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. The LA should not be used by a teaching department or the instructor unless it is absolutely necessary; when it is used the following procedure should be used:

- a. Return the Grade Report Rolls at the regularly scheduled time with the LA clearly marked.
- b. Secure a Late Grade Report Form (pink) from Registration and Records or departmental office.
- c. Return late grades on the Late Grade Report Form (pink) at the earliest possible time and not later than 15 days after the examination.

NOTE: It should be kept in mind that the semester grade reports of those students who receive an LA will not be complete. This situation often causes students to be uninformed as to their academic eligibility and as to the correctness of their schedules for the following semester.

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

GRADE POINT AVERAGE

The number of credit hours attempted in a semester or summer session (for which grades of A, B, C, D, NC are received) is divided into the total number of grade points earned to arrive at the Grade Point Average (GPA). The Grade Point Average of work attempted will be computed to three decimal points and used solely for class ranking, academic recognition, and admission to certain programs as approved by the Provost.

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 a NC 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 NC)	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.

Semester Dean's List Any 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 is placed on the semester Dean's List. 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 achievement is noted on the student's grade report and permanent academic record.

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.

At registration students will be asked to 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 to their parents or guardians. However, students may elect to have their grade reports sent 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. Also, news stories about Dean's List students are sent to N.C. newspapers based on hometown information furnished Registration and Records.

ACADEMIC WARNING

At the end of any 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 total credit hours passed with grades of A, B, C, S, or CR falls below 60 percent of that student's total credit hours attempted at NCSU.

ACADEMIC RETENTION-SUSPENSION RULES

An undergraduate student who has attempted 28 credit hours or more at NCSU will be suspended at the end of any academic year or summer session if that student fails to pass with grades of C or better (A, B, S, and CR) at least 50 percent of the cumulative hours attempted at NCSU. Total credit hours passed with grades of C or better are divided by total credit hours attempted to determine this percentage. Grades of D, NC, U (plus F, FD, FA, and FI which were used prior to the 1974 fall semester) are less than satisfactory.

The exceptions to the above suspension policy are that no student will be suspended (a) at the end of the fall semester, (b) at the end of any semester in which that student has passed nine or more credit hours with grades of C or better (A, B, S, and CR), or 50 percent of the hours completed in the case of a student officially enrolled that semester for less than 12 credit hours at the end of the second week of classes, or (c) at the end of either summer session, if that student was not in a suspended status prior to that summer session.

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 meet the normal requirements for readmission.

Suspended students are eligible to attend the summer session at NCSU and/or take Independent Study by Extension (formerly correspondence) courses offered by NCSU to improve their academic standing and will be eligible for readmission when they have raised their cumulative percentage of total hours passed with grades of C, its equivalent or better, to at least 50 percent of the total hours attempted at NCSU.

Students who were suspended prior to the 1974 fall semester under the quality-point-deficit system will be eligible for readmission if they have passed with grades of A, B, C, S, and CR at least 50 percent of the total hours attempted at NCSU. Suspended students who have had a break in residency must file an Application for Readmission.

WITHDRAWAL FROM THE UNIVERSITY

Students who wish to drop *all* the course work for which they are registered must withdraw from the University. Students who withdraw after the first two weeks of classes in a regular semester or after the fourth day of classes in a sum-

mer session will not receive any refund of tuition and fees unless a prorated refund is authorized by the Committee on Refunds for medical or unusual hardship cases.

Neither courses nor grades are recorded on the permanent record for students who withdraw during the drop period. After the close of the official drop period, withdrawals without academic penalty are granted only when exceptional circumstances such as documented medical or hardship situations exist (including instances where not being permitted to withdraw without penalty would clearly cause the student undue hardship). In such cases neither courses nor grades are recorded on the permanent record.

Regular undergraduate degree and unclassified students initiate the official withdrawal process with the Counseling Center, 200 Harris. In the case of The Graduate School and several other schools approval of the dean is required. Parental approval to withdraw may be required for single students who are under eighteen.

Undergraduate special students and post-baccalaureate studies students initiate the official withdrawal process with the Division of Continuing Education, McKimmon Center.

Withdrawal during a semester does not constitute a break in residence if a student returns the semester immediately following.

READMISSION OF FORMER AND SUSPENDED STUDENTS

A Former Student Returning is one who was not in attendance at all during the fall or spring semester prior to applying for re-admission. All former students returning, both graduates and undergraduates, except Special students must apply for readmission to the Department of Registration and Records, North Carolina State University, P.O. Box 5745, Raleigh, North Carolina 27650 at least 30 days prior to the date of desired enrollment. A student who receives a bachelor's degree must (a) apply for admission to the Graduate School; or (b) apply for admission as a Post-Baccalaureate Studies (PBS) student through the Division of Continuing Education; 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. Preregistration alone is not sufficient to enable the student to be readmitted.

1. A student who was eligible to continue at North Carolina State University at the time of his leaving is eligible to return (except as indicated in (a) or (b) immediately below). Students in this category need only complete a readmission form.
 - a. A student who was eligible to continue at the time of his leaving but who has subsequently taken work at another institution and earned less than a C average on such work must complete a readmission form and write a letter of petition to the Admissions Committee.
 - b. A student eligible to continue at the time of his leaving who has subsequently taken correspondence and/or extension work at North Carolina State University and earned grades which resulted in suspension must complete a readmission form and write a letter of petition to the Admissions Committee.
2. *Procedures for Readmission of Suspended Students.*
 - a. *Automatic Readmission.* A student who is academically suspended may do one or both of the following: (1) attend any number of summer sessions at

NCSU; (2) enroll in NCSU Independent Study by Extension courses (formerly called correspondence courses) offered through the UNC Extension Division. (Address: Independent Study by Extension, 121 Abernethy Hall, UNC, Chapel Hill, N.C. 27514, Phone: 919-933-1104)

When by one or both of these methods a suspended student has improved his or her academic standing to the extent that the cumulative percentage of total hours passed with grades of C, or its equivalent or better, is at least 50 percent of the total hours attempted at NCSU, 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. NOTE: Courses taken at an institution other than NCSU by a student suspended at NCSU do not affect the suspension status.

- 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 or Independent Study by Extension 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 School or Independent Study by Extension courses.

The letter should be mailed to: Department of Registration and Records, Attention: Admissions Committee, North Carolina State University, P.O. Box 5745, Raleigh, N.C. 27650. The letter must reach the Department of Registration and Records by the following deadlines:

1. *No later* than 2 weeks before fall semester Registration Day for students who did not attend summer school or who attended first summer session only;
2. *No later* than 1 week before fall semester Registration Day for students who attended second summer session.

NOTE: The Admissions Committee meets prior to Registration Day. All material must be received in accordance with the above dates.

3. *Curriculum Change.* A former student returning who desires a change of curriculum must have his records transferred to the new school and submit a properly validated Curriculum Change Form to the Department of Registration and Records, 100 Harris Hall, before readmission can be processed.

4. *Transfer Credit.* Transcripts of college credit work for new transfer students and for North Carolina State University students who have taken course work at

another institution are evaluated by the dean of the appropriate school to determine how the work applies to each student's degree program.

Students taking courses elsewhere for transfer back to North Carolina State University must make prior arrangements with their deans to insure receiving credit for the work done. Transfer credit is not recorded on a former student's permanent record until after he or she has been readmitted and has reenrolled.

REPEATING COURSES

Students who repeat a course, regardless of the grade previously made, will have both grades counted in the cumulative Grade Point Average. Undergraduate students may be allowed as many semester hours as are appropriate in the departmental curriculum for courses that are: 1) titled seminar, special problems, special topics, independent study or research (usually numbered 490-499 or 590-599); 2) cover topics different from those studied when the courses were taken previously. However, for any courses other than one that satisfies these conditions, if a student repeats and passes the course both times, the semester hours will be counted only once toward the number of hours required for graduation.

The adviser's approval is required for a student to repeat any course previously passed. Approval should not be given when a student wishes to repeat a course already passed with a grade of A or B. Nor should it be given when: 1) a student wishes to repeat a lower division course that he or she has passed with a grade of C or better after having successfully completed an advanced course covering the same material or 2) a student wishes to repeat a lower level course that he or she has passed with a C or better which is a prerequisite for an advanced course that he or she had already successfully completed.

CREDIT BY EXAMINATION THROUGH INDEPENDENT STUDY

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 Study may (with the approval of the Independent Study 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 the Independent Study Office, 121 Abernethy Hall, UNC-CH, Chapel Hill, N.C. 27514 (933-1104).

Students currently enrolled on campus are not eligible for credit by examination through Independent Study. 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 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 courses must be included under the free elective category of the specific 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) and will have no effect on the student's Grade Point Average. "Credit-only" work may drop a student below 12 hours of course work for which grade points are earned and thus make him or her ineligible for the semester Dean's List. The course and its grade will be counted in the cumulative hours attempted under the suspension retention policy.

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.

(NOTE: Veteran's benefits are governed by Veterans Administration regulation concerning audits. See Veterans Affairs Office, 220 Harris.)

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

Audits in subjects in which the graduate student has had no previous experience will be evaluated at full credit value in determining course loads. Audits taken as repetition of work previously accomplished are considered at one-half their credit value in calculating course loads. With the single exception of foreign language audits, all audit registrations must fall within the maximum permissible course loads. Audits are not permitted for students registering for courses carrying a GR prefix. While audit registrations are evaluated for purposes of determining permissive course loads in terms of the regulations of the Graduate School, the Office of Business Affairs considers all audits, excepting one permitted free of charge, in terms of full credit value in calculating the graduate student's tuition.

CREDIT BY EXAMINATION

Undergraduate students currently registered at NCSU (degree, unclassified, or special) desiring to take an examination for course credit in lieu of enrolling for

that course 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. 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 Late Grade Report Form (pink) 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 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, using a Schedule Revision Form.

CURRICULUM CHANGE

Undergraduate students wishing to change from one curriculum to another must report to the dean's office of the school offering the curriculum in which entrance is desired and request acceptance into the new school or 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 school, 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 school and department. From the standpoint of advising, preregistration, 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.

GRADUATION REQUIREMENTS

Students are eligible for graduation when they have satisfied all the academic requirements of their degree program as specified by their major department, their school, and NCSU.

Limited D Grades—A grade of C, its equivalent or better, is required for each course in a student's degree program. A student's major department, however, (a) may accept up to 12 credit hours of *D*'s for graduation and (b) may designate courses or categories of courses in which *D*'s will not be accepted for graduation. A statement of departmental policy in this matter shall accompany all curricula material distributed to students. All *D* grades earned prior to 1974 fall semester may be used to satisfy course requirements insofar as they were allowed at that time by the department granting the degree. No more than 12 additional credits of *D* earned in the 1976 fall semester, or thereafter, may be used to satisfy course requirements for courses in which the *D* grade is acceptable to the department granting the degree.

Grade Point Average—Since the 1974 fall semester, the Grade Point Average has not been a part of the graduation requirements.

Previous Quality Point Deficits Students who have quality point deficits incurred prior to the 1974 fall semester may select one of two options to achieve eligibility for graduation:

- a. making up those quality point deficits which were incurred prior to the 1974 fall semester by earning a sufficient number of *A* or *B* grades. (*D* grades may be repeated for this purpose.) *NC* grades received during the 1974 fall semester or thereafter and *D* grades received during the 1976 fall semester or thereafter shall have no effect on quality point deficits incurred by students prior to the 1974 fall semester; or
- b. repeating with a *C* grade or better all courses required for graduation in which the previous grade was a *D* and for which *D* grades have been determined to be unacceptable by the student's major department. Under this option the courses repeated may not be counted as free electives and the make-up of any pre-existing quality point deficit shall not be required.

Transfer and Independent Study Credits Individual departments and/or schools may determine their own limits, if any, of credit hours for transfer and/or independent study by extension (formerly correspondence) courses.

Residence Requirements—A transfer student, to be eligible for a bachelor's degree, normally must earn at least 20 of his or her last 30 hours of credit in residence on this campus; however, individual departments and/or schools may waive this guideline and determine their own residence requirements for a bachelor's degree.

SECOND DEGREE

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 the student registers in one school or department and, with the cooperation of the second school or department, works out his or her program to cover the requirements for both. The student must file an approved Curriculum Change Form labeled "Second Degree" with Registration and Records.

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 one dollar 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 released only upon the *written* request of the student to Registration and Records, P.O. Box 5745, Raleigh, N.C. 27650.

General Information

FOOD SERVICE

Food Service is provided at the University Student Center, the University Student Center Annex and in six campus snack bars. The average cost of food for the academic year is estimated to be \$990.

TRANSPORTATION

A car is not a necessity on campus and often a liability. Students are encouraged to use forms of transportation other than personal automobiles if and when possible. Bus tickets are sold to students at discount rates at the Student Center and Traffic Records Office. Most students who live off campus will be able to park on a seniority basis—graduate, senior, junior, but because of expected high demand many sophomores and probably all freshmen will not be allowed to park a car on campus. Motorcycles and bicycles are encouraged. Parking fees are \$35 per year to \$15 per year depending on the area, and motorcycles are \$10 per year. There is no charge for bicycle registration.

Individuals are responsible for compliance with the Parking and Traffic Rules and Regulations distributed in the Fall.

LAUNDRY

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 AND BLANKET RENTAL

During the regular academic year and summer school the student may rent at a reasonable rate a linen bundle (consisting of 2 twin bed sheets, 3 towels, pillowcase) and/or pillow. The student may exchange his linen weekly at the branch of-

ices in the residence halls or the main laundry on Yarborough Drive. An N.C. State University monogrammed blanket is also sold through this program. These services are available to both on- and off-campus students. Application forms for the regular academic year are mailed in July to each student. Students wishing the service for summer school terms should apply to Office of Auxiliary Services, 203 Holladay Hall, N.C. State University.

Upon withdrawal from the program, and at the request of the user, refunds are made based on weeks used and less a small handling charge.

HEALTH

The University seeks to safeguard the health of the student in every way possible. The Student Health Service, located in Clark Hall Infirmary, offers medical care to students on an outpatient and inpatient basis. The 40 bed facility is staffed by full-time physicians, registered nurses and other medical support personnel.

During the scheduled academic sessions, the Health Service is open 24 hours a day, seven days a week. Physicians maintain regular office hours Monday through Friday and are on call at all times to assist the nurses on duty when the condition of a patient warrants immediate attention.

Each full-time student pays a medical fee which covers professional services either as an outpatient or inpatient; i.e., visits to M.D., routine laboratory procedures and X rays performed in the Student Health Service, and medications available in the student pharmacy.

In all cases of serious illness or injury, notice to the immediate family is strongly encouraged. This notice will be made by the attending physician unless expressly forbidden by the student. All health and medical information is confidential and is not divulged to anyone without the written consent of the patient.

A physical examination is required of all students admitted to a degree program and all non-degree students taking 8 or more hours of course work. The completed examination form should be mailed to the Student Health Service 30 days prior to registering for the first time. Physical examination forms may be obtained from the Office of Admissions.

ACCIDENT AND HEALTH INSURANCE

The University offers a student accident and health insurance program. The insurance covers the surgical, accident, and hospital needs of the student as a supplement to the infirmary services. Each year complete information will be made available to students before school opens.

ORIENTATION

During June, an orientation program is held for freshmen entering the University for the first time in the fall semester. Freshmen are expected to attend the two-day program that corresponds with their major field of study. A "late" orientation is held in August just prior to the fall semester for entering freshmen who cannot attend the June orientation. Transfer students are encouraged to attend the Transfer Student Orientation Program held two days before registration day.

COUNSELING

The Counseling Center in Harris Hall has a staff of professional counselors to help students with adjustment to college life, vocational and curricular choice and other problems. The Center administers vocational tests and maintains a file of occupational information to help guide students in career selection. Students may come to the Center on their own accord, or they may be referred by teachers, advisers or other members of the University staff. There normally is no charge for conferences.

FACULTY ADVISERS

Students have the primary responsibility for planning their academic program and meeting graduation requirements. Each regular degree student is assigned a faculty adviser who is usually in the student's major field of study to assist the student.

School and department coordinators of advising, deans, directors of instruction, department heads and members of the faculty keep office hours and expect students to consult them whenever necessary.

FOREIGN STUDENTS

More than 800 students from approximately 75 countries attend the University and provide a valuable component to the campus. The International Student Office assists these students with immigration matters, passports, currency permits, tax information, and medical, personal, and social problems.

An orientation program for new foreign students is conducted during the week preceeding late registration.

Foreign students are required to subscribe to University student health insurance or provide proof of other adequate coverage. A special course in English for Foreign Students (FLE) is offered 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 foreign and American students. The International Program of Alexander Hall provides opportunities for intercultural exchange for undergraduate foreign and American students in the residence hall setting.

STUDY ABROAD

A self-help library on opportunities for work, study, and travel abroad is located in the International Student Office. Information on Fulbright Grants for Graduate Study Abroad and other scholarships is also available through the Office.

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 personal career 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, and will advise students of job opportunities given to the center by mail or telephone.

COOPERATING RALEIGH COLLEGES

Cooperating Raleigh Colleges is a consortium, or voluntary organization, comprised of North Carolina State University, Meredith College, Peace College, St. Augustine's College, St. Mary's College, and Shaw University. The organization promotes interinstitutional cooperation and cooperative educational activities among the six institutions. Agreements provide the opportunity for any student to enroll at another institution for courses not offered at one's home campus.

Student Activities

The University makes every effort to provide surroundings pleasant and conducive to intellectual growth. Respecting the student as an individual, the University assures him or her the maximum of personal liberty within the limits necessary for orderly progression of class work. In return, the student is expected to pay serious attention to his or her purpose in attending this University and to observe rules of conduct consistent with maturity. Through the various services and activities identified with everyday life on campus, as well as through several extracurricular organizations and functions, the student at N. C. State has an opportunity for acquiring experience in group leadership and community living which may serve one well in one's professional career.

STUDENT BODY GOVERNMENT AND STUDENT JUDICIAL SYSTEM

Students at the University are members of a self-governing community. Legislative, executive and judicial authority, insofar as student affairs are concerned, rest with the student government which operates within the framework of overall University administration. Student government members and judicial department members are elected in campus-wide elections.

CLUBS AND SOCIETIES

Honorary—University-wide honorary societies include Golden Chain, senior leadership; Blue Key, junior leadership; Thirty and Three, sophomore leadership; Phi Eta Sigma and Alpha Lambda Delta, freshman scholarship; and Phi Kappa Phi, junior, and senior and graduate students scholarship.

Professional and Technical Organizations The schools and departments of the University sponsor or supervise a large number of professional and technical

societies and clubs. These organizations contribute substantially to students' professional and social growth.

Social Fraternities and Sororities Twenty-two national social fraternities have chapters at State. They are Alpha Gamma Rho, Alpha Phi Alpha, Alpha Sigma Phi, Delta Sigma Phi, Delta Upsilon, Farm House, Kappa Alpha, Kappa Sigma, Lambda Chi Alpha, Omega Psi Phi, Phi Kappa Tau, Pi Kappa Alpha, Pi Kappa Phi, Sigma Alpha Epsilon, Sigma Alpha Mu, Sigma Chi, Sigma Nu, Sigma Phi Epsilon, Sigma Pi, Sigma Tau Gamma, Tau Kappa Epsilon, and Theta Chi.

State has five national social sororities, Alpha Delta Pi, Alpha Kappa Alpha, Alpha Phi, Delta Sigma Theta, and Sigma Kappa.

Other Organizations—There are over 200 student organizations that a student may join or participate in. These organizations cater to all interests and levels of involvement, and most are open to all students.

STUDENT PUBLICATIONS

North Carolina State students have the opportunity to edit and manage a variety of student-oriented publications. By working on these publications a student gains valuable extra-curricular experience in journalism, broadcasting, production and design, leadership, and management.

There are four publications supported in large part by a designated portion of each student's non-academic fees and staffed entirely by students. These publications include the *Agromeck*, the *Technician*, the *Windhover* and WKNC-FM.

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

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

WKNC, 88.1 FM, is the student radio station operating at 1000 watts, which enables it to be heard within a 30-mile radius of Raleigh. The station operates 21 hours a day with a full staff of engineers, disc jockeys, and news personnel.

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

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

ATHLETICS

North Carolina State University offers a variety of athletic activities. In addition to voluntary programs of intramural and intercollegiate sports, freshmen and sophomores are required to take two to four semesters of physical education. Juniors and seniors take physical education as an elective.

Intercollegiate The Department of Athletics conducts the University's intercollegiate athletics program involving 14 varsity sports for men and nine for women.

The athletics program is administered by the athletics director with the Athletics Council, made up of seven faculty, three alumni and three students. The

program is self-supporting and is operated through gate receipts and student fees. Athletics grants-in-aid are provided through the North Carolina State Student Aid Association (Wolfpack Club) upon recommendation of the coach of each sport.

The University facilities include Carter Stadium (44,000 seats), Reynolds Coliseum (12,000 for basketball), and Doak Field (3,800 seats for baseball); a nine-lane tartan track; and a 2,200 seat swimming stadium, with a 25-yard by 25-meter pool.

INTRAMURALS

The University maintains an extensive program of intramural sports administered by the Department of Physical Education. Intramural activities are divided into three basic programs: the traditional sports program, the sports club program and the annual events program.

In the traditional sports program individual and team sports are offered to both men and women with participation being strictly voluntary. Competition is divided into five divisions: (1) residence halls, (2) fraternity, (3) open, (4) women, and (5) co-recreational. Sixteen sports are offered in the residence hall and fraternity divisions, while thirteen sports are offered in the open division. In the women's division competition is available in thirteen different activities. Also, the men and women may participate in six co-recreational activities.

The sports club program is offered to individuals interested in opportunities to participate in certain activities usually at a higher skill level than the traditional sports program affords. At the present time, the active clubs on campus are: (1) Weight Training, (2) Badminton, (3) Bicycle, (4) Table Tennis, (5) Outing, (6) Bowling, (7) Dance, (8) Ice Hockey, (9) Judo, (10) Sailing, (11) Volleyball, and (12) Water Ski.

The North Carolina State University student also has the opportunity to participate in the annual events program. The men enjoy competition of Big "4" Day with students from UNC-Chapel Hill, Wake Forest University and Duke University. During Consolidated University Co-Rec Day teams, men and women, from North Carolina State compete against teams from UNC-Chapel Hill, UNC Charlotte, and UNC-Greensboro.

MUSICAL ORGANIZATIONS

Since the early days of North Carolina State, 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 Fanfare Band, the Brass Band and the Marching Band make up the four divisions of the N. C. State bands. Each band serves a specific purpose and assignments are made according to individual in-

terests and abilities. The Symphonic, Fanfare and Brass Bands are concert organizations, with the Symphonic Band having the most rigid requirements.

Choral Groups The Varsity Men's Glee Club, the University Choir, the Women's Chorale, the University Singers, the Chamber Music Singers and the New Horizons Choir make up the six choral divisions. Placement in an organization is made according to the student's abilities and interest. These groups present concerts each year, both on and off campus, as well as making radio and television appearances, recordings, tours and providing small ensembles for special occasions.

Orchestras Members of the orchestras consist of NCSU students and faculty, students and faculty from area colleges and universities, and community people. Placement is according to individual ability, interest, and time to practice and rehearse. 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.

Musician-in-Residence—North Carolina State University established this special chair in the Music Department to facilitate the University's cultural development. Internationally known musicians are appointed to this position on a rotating basis. They are available without charge to all University classes and organizations for concerts and presentations.

UNIVERSITY STUDENT CENTER

The University Student Center, with its branches in the Frank Thompson building and in the Erdahl-Cloyd wing of the D. H. Hill Library, provides a focal point for much of the extra-curricular life on campus. The University Student Center is guided by student officers, committee chairmen and a student-faculty Board of Directors. The programs it sponsors include training in all aspects of theatre, plays produced by students, instruction and independent work in all kinds of crafts, a wide range of professional performances in jazz, pops, folk and classical music, dance and theatre. There are student committees working in all of these areas. Other student committees present lectures, films, games tournaments, black cultural programs, coffee houses, dances and dance instruction, gallery exhibits, international student programs and opportunities for volunteer service.

The facilities in the University Student Center and its branches include two theatres, a craft center, vending areas, newsstands, games rooms, a barber shop, the newspaper offices, yearbook office, radio station, Student Government offices, meeting rooms, offices for the IFC and IRC, off-campus students and space for religious workers.

In the Center and in the Erdahl-Cloyd annex are a wide variety of food service facilities including a cafeteria, two snack bars, a delicatessen, ice cream bar, buffetaria and salad bar.

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.

The physical elements of the theatre are flexible, with seating, walls and staging that can be arranged in a variety of combinations to form any kind of theatre from proscenium to in-the-round.

Two types of productions are presented each year. The "Majors" 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.

Thompson Theatre works closely with the Department of Speech-Communication which offers some courses for those interested in theatre.

The University Players is the student organization within the theatre which recommends theatre operating policies and helps to determine the theatre's program.

STEWART THEATRE

Stewart Theatre, located in the University Student Center, offers an opportunity for students and other members of the University community to see and hear the best in professional performances: plays, jazz, pops, folk and chamber music concerts, both modern dance and ballet, films and lectures. The theatre also sponsors a series of musicals at Memorial Auditorium in downtown Raleigh. Special rates are available to NCSU students.

CRAFTS CENTER

Located on the ground floor of the Thompson building is one of the finest crafts facilities on a university campus in the southeast. Instruction is offered in ceramics, woodworking, photography, textile design, weaving and a host of 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.

Graduate School

Peele Hall

V. T. Stannett, *Vice Provost and Graduate Dean*

R. James Peeler, *Associate Dean*

The Graduate School provides instruction and facilities for advanced study and research in the fields of agriculture and life sciences, design, education, engineering, forestry, humanities and social sciences, physical and mathematical sciences, and textiles.

The School is currently composed of more than 1,100 graduate faculty members within the eight academic schools. 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 2,500 men and women from all areas of the United States and about 70 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 North Carolina State University, see pages 17-18. Consult the Graduate Catalog for details on programs and admission.

University Extension

1911 Building and Jane S. McKimmon Center

W. L. Turner, *Vice Chancellor for Extension and Public Service*

M. F. Hester, *Assistant to the Vice Chancellor for Extension and Public Service*

R. K. White, *Director, Adult Special Programs*

C. W. Hart, *Special Assistant for Development*

The University administration is linked to the faculty of the various schools and with clientele groups throughout the state through the Vice Chancellor for Extension and Public Service, extension field staff, and through advisory or liaison groups. The University's overall extension program is coordinated through the Vice Chancellor for Extension and Public Service who administers program development, management of interschool and interinstitutional extension programs and projects and provides staff assistance for campus wide extension programs.

Division of Continuing Education

Jane S. McKimmon Center

R. A. Mabry, *Director*

Associate Directors: J. Porter, D. B. Stansel; *Assistant Director:* C. F. Kolb; *Assistant to the Director:* H. H. Ethridge; *Continuing Education Specialists:* K. R. Crump, *In Charge*, J. F. Cudd, Jr., D. Fender, D. S. Jackson, Rosemary Jones, J. F. W. Schulze, A. Lanier, H. G. Walker.

The Division of Continuing Education of N. C. State is the statewide adult education service linking the University, its scholars, research, and resources with the people and communities of the State. The programs vary in length and format from one-day conferences and short courses to regular semester-length classes and educational television.

The Division's programs are designed to meet the needs of any adult who can benefit from university-level study. The instructional staff consists of University

faculty, from N.C. State and other institutions and authorities in specific fields.

Only those programs appropriate to the standards of scholarship and instruction of N.C. State are offered. Both credit and noncredit programs are offered on the University campus, in communities throughout the State and by correspondence instruction.

Correspondence Courses The Division offers more than 35 different courses in 14 subject areas. These courses are administered through the "Independent Study by Extension" UNC Extension Division, 121 Abernethy Hall, Chapel Hill, N.C. 27514.

Credit and Noncredit Evening Classes The Division offers, during the fall and spring semesters, a series of credit and noncredit courses on the University campus. The credit courses are sponsored and taught by the University's academic departments and are generally conducted in the late afternoon and evening. These courses are offered to the already occupied mature person who is unable to attend classes during daytime hours. Approximately 110 courses in a variety of subject areas are given each semester. The noncredit classes are designed for cultural and professional enrichment.

Off-Campus Credit Courses Extension classes are offered throughout the State. These classes are mainly on a need basis or by request from organizations or special groups. Courses are available in almost all subject matter areas from engineering to the social sciences. In 1977-78 the Division administered 93 credit classes in 31 different locations with registration totaling approximately 1,400.

Short Courses, Institutes, and Conferences Short courses, institutes and conference programs, more than any others, mark the University's efforts to meet its Land-Grant tradition of providing education to all the people. The scope of the programs include: agriculture, engineering, forestry, textiles, the physical sciences, economics, management, communications, education, and recreation. During 1977-78 there were 267 courses offered with registrations totaling over 12,400.

The University awards Continuing Education Units to participants in qualified programs. Continuing Education Units are a part of a nationwide recording system to provide a uniform measure of attainment in noncredit educational programs. One CEU at N.C. State is defined as "ten contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction."

Summer Sessions

C. F. Kolb, *Director*

The Summer Sessions at N. C. State offer an extensive education program to meet the varied needs and interests of almost 9,000 students who come to the campus each summer.

Each of the University's eight schools represented by more than 55 different departments offers instruction in over 600 courses, more than 40 percent of which are at the graduate level. A faculty of more than 300 participates in programs for summer study. Six of the eight schools offer regular courses during the two five-

week terms. Design offers one nine-week program. Forest Resources conducts a summer camp for sophomores and two five-week practicums. In addition, numerous special programs and institutes are offered during the summer. Summer courses and special programs meet the needs of undergraduate and graduate students of N. C. State and visiting students pursuing degrees from other institutions.

For information regarding summer activities write: Director of Summer Sessions, Box 5125, Raleigh, North Carolina 27650.

Center for Urban Affairs and Community Services

Jane S. McKimmon Center

D. A. Norris, *Associate Director*

F. E. Emory, Sr., *Assistant Director*

S. Cameron, *Assistant Director*

Operations Group Managers: E. H. Snipes, L. T. Charest, P. H. A. Miller, J. S. Davies, W. A. Freyer, P. F. Taylor

The Center for Urban Affairs and Community Services provides a focal point for bringing the University's research, educational and public service resources to bear on problems associated with urbanization. The Center has three goals: (1) to provide technical assistance to governmental and non-profit organizations in planning, management and service delivery; (2) to provide experiential educational opportunities for graduate and undergraduate students; and (3) to develop and support research opportunities for faculty and upper-level graduate students.

Work at the Center is organized into six operations groups. *The Systems Development Group* provides technical assistance in the design and development of management information systems. *The Applied Research Group* engages in field research projects which enhance capacities for projecting trends, planning and evaluation. *The Systems Engineering Group* develops tools and procedures for making better decisions about complex issues in the public sector. *The Community Education Group* provides training and develops information programs to increase citizen participation in government and community groups.

The work of the four program operations groups are aided by two support groups. *The Computer Services Group* designs and develops the computer programs required by Center projects. This group also carries out research in the development of new computer techniques which will be useful for state and local governments. *The Administrative Services Group* supports the Urban Affairs library and publishes the many documents associated with the Center's projects and studies.

The Center for Urban Affairs and Community Services coordinates its work with other members of the University of North Carolina's Urban Studies program

through the Urban Studies Council. The Council enables universities and institutions across the state to pool their efforts to encourage productivity and responsiveness of government and community institutions.

University Studies

Harrelson Hall

Professor A. C. Barefoot, Head

Professors: D. Huisingh, J. R. Lambert Jr., J. C. Wallace; Assistant Professors: R. L. Hoffman, Elizabeth Wheeler; Lecturer: C. L. Stalnaker

University Studies is an academic unit responsible for interdisciplinary programs dealing with contemporary 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 without prerequisites to students in all curricula.

Music

Price Music Center

J. P. Watson, Director of Music

Assistant Directors: D. B. Adcock, M. C. Bliss, R. B. Petters, P. H. Vogel, E. B. Ward; Musician-in-Residence: filled by a new appointment each year

The Music Department teaches students to develop their abilities as consumers as well as producers of music. Introductory and survey courses in the history, theory, and appreciation of music provide academic electives for all curricula on campus. In addition, the Department provides abundant opportunities in instrumental and choral activities. From very large organizations to small ensembles, offerings are provided for those who wish to maintain and improve their abilities by participating in music.

Music and the Scientific Disciplines—The Schools of Engineering, Humanities and Social Sciences, and Forest Resources, the Department of Music and the Division of University Studies are cooperating to foster interaction between the scientific disciplines and music.

The Engineering Operations Program offers a unique B.S. degree program which combines courses in music, instruments and engineering as they relate to the design and manufacture of musical instruments. Two courses concerned with a scientific study of musical sounds and instruments are now offered: Science, Materials and Technology of Music Instrument Making and Acoustics of Music. In addition, people who have expertise in the technology of music are invited to the campus each year to deliver seminars on such topics as the acoustical basis for production of tones in wind instruments and the relationship between physical structure and tone quality in violins.

Military Education and Training

DEPARTMENT OF MILITARY SCIENCE (ARMY ROTC)

Professor: Lieutenant Colonel S. A. Holcomb; *Instructors:* Major M. P. Kehoe, Major J. E. Covington, Captain C. S. Cox, Captain M. J. O'Connor, Captain C. M. Rowley.

DEPARTMENT OF AEROSPACE STUDIES (AIR FORCE ROTC)

Professor: Lieutenant Colonel H. D. Woods; *Instructors:* Major M. T. Curran, Captain J. E. Harper, Captain T. C. Seebo II

The Department of Military Science (Army ROTC) and the Department of Aerospace Studies (Air Force ROTC) are separate academic and administrative subdivisions of the institution.

The mission of the Army ROTC Program is to produce well-educated commissioned officers in sufficient numbers to meet Army requirements.

The mission of the Air Force Reserve Officers' Training Corps (AFROTC) is to recruit and, through a college campus education program, commission second lieutenants in response to Air Force requirements.

Course of Instruction

Army ROTC The Program of Instruction for the Army ROTC consists of a two-year basic course (freshmen and sophomore level) which is followed by a two-year Advanced Course (junior and senior-level). Students incur no obligation from participation in the basic course. Also available is an accelerated two-year program for upperclassmen which entails completion of a six-week summer basic camp prior to direct entry into the Advanced Course. All Advanced Course cadets participate in a six-week Advanced Camp during the summer between their academic junior and senior years.

Air Force ROTC The program of instruction consists of a two-year general military course, a field training course, and a two-year professional officer course.

The Air Force ROTC unit conducts a flight instruction program. All Air Force ROTC Cadets who are qualified and have volunteered for active duty pilot training receive 25 hours of flying. The program includes ground school training.

Students desiring to enter either the Army or Air Force ROTC Program should respectively contact the Military Science Department, Room 154, Reynolds Coliseum or the Aerospace Studies Department, Room 145, Reynolds Coliseum.

Satisfactory completion of the Advanced Courses qualifies a cadet for commissioning as a Second Lieutenant in the Army or Air Force Reserve upon graduation from the University.

Selection

Army ROTC—The selection of Advanced-Course students is made from applicants who are physically qualified and who have demonstrated above average performance in the basic course. Armed Forces veterans are also eligible to apply for enrollment in the Advanced Course upon the approval of the Professor of Military

Science and the University Administration. Such applicants must be in good academic standing, physically qualified, and not have reached their 27th birthday.

Air Force ROTC A student enrolled in the Air Force ROTC may pursue a four-year program or a two-year program. Both offer the opportunity for receiving an AFROTC scholarship.

Students, to meet enrollment requirements for the professional officer course, must achieve a qualifying score on the Air Force Officer Qualification Test (AFOQT) and the SAT/ACT, meet necessary physical requirements, and must have good academic records. Qualified veterans desiring a commission through an Air Force ROTC program complete the two-year advanced program and, in most cases, attend four weeks of field training. Non-veterans must complete the two-year general military course, the two-year professional officer course, and attend four weeks of field training. Non-veterans may elect to successfully complete six weeks field training and the two-year professional officer course in lieu of the above four-year program. Cadets must complete either program before their 30th birthday to qualify for a commission.

Transfer Credit—Credit is allowed for work at other institutions having ROTC units established in accordance with the provisions of the National Defense Act and regulations governing the ROTC.

Financial Aid

Students in the Army basic or Air Force general military course, other than scholarship students, receive no monetary allowance. For summer training of four to six weeks, students receive pay and travel allowance. All Army and Air Force students in their last two years receive a subsistence allowance of \$100 (tax free) per month. Scholarships which pay for tuition, all fees, and textbooks are available to both Army and Air Force cadets.

Army ROTC One-, two-, three- and four-year scholarships are available to selected Army ROTC students who are strongly motivated toward a career in the Army.

Air Force ROTC—A limited number of selected students enrolled in the Air Force ROTC program may qualify for two-, two and one half-, three-, three and one half-, and four-year scholarships.

Uniforms Uniforms for Army and Air Force ROTC are provided by the Federal government.

Organization

Army The Army ROTC unit at N. C. State consists of a cadet battalion, commanded by a cadet lieutenant colonel, and comprised of a headquarters company and lettered companies. The cadet lieutenant colonel and all other cadet officers are selected from students enrolled in the second year advanced course. Cadet sergeant majors, first sergeants and sergeants first class are appointed from students enrolled in the first year advanced course. Certain specially selected students in the second year basic course also are appointed as cadet non-commissioned officers. Cadet officers and non-commissioned officers conduct all laboratory instruction with supervision by the University's Army faculty.

Air Force The Air Force ROTC unit is organized as a cadet group (commanded by a cadet colonel) with an appropriate number of squadrons; the squadrons are composed of flights and squads. The group, squadron and flight commanders and their staff are cadet commissioned officers and are selected from cadets enrolled in the professional officers course. All other positions are held by cadet non-commissioned officers who are selected from general military course cadets. Cadet officers and non-commissioned officers plan and conduct the cadet group operation with AFROTC faculty supervision.

Distinguished Students

The University names outstanding students of Army ROTC and Air Force ROTC as Distinguished Military Students or Distinguished Air Force ROTC Cadets. These students may, upon graduation, be designated Distinguished Military Graduates or Distinguished Air Force ROTC Graduates. Distinguished Military Graduates may be commissioned in the Regular Army.

Library, Computing, and Research Facilities

THE D. H. HILL LIBRARY

The D. H. Hill Library's book and bound journal collection totals some 850,000 volumes and is particularly strong in the biological and physical sciences, in engineering, agriculture, and forestry. The arts, humanities, and social sciences are also well represented. The library regularly receives more than 7,200 magazines, journals and other periodical publications.

These special collections form on-campus branches of the Hill Library—the Burlington Textiles Library in Nelson Hall containing holdings in textile technology and textile chemistry; the Harry B. Lyons Design Library in Brooks Hall containing holdings in architecture, landscape architecture and product design; and the Forest Resources Library and reading room in Biltmore Hall.

The library's collections are open to all students and faculty for over 100 hours per week.

COMPUTING FACILITIES

North Carolina State University is one of the three universities owning the Triangle Universities Computation Center (TUCC) located in Research Triangle Park near Raleigh. Other participating institutions are the University of North Carolina at Chapel Hill and Duke University at Durham.

Central equipment located at TUCC is an IBM System 370 Model 165 and a Model 165-II, each with 4.0 million characters of memory. A vast quantity of disk storage is available as well as extensive teleprocessing equipment for communication with member universities and other institutions throughout the State. The time sharing

option (TSO) of IBM is supported extensively. Hewlett Packard HP 2000 Systems provide interactive services using the BASIC language.

The principal computer at the N. C. State Computing Center is an Intel AS/4 with one million characters of memory. It provides high-speed communication with TUCC and simultaneously processes administrative data processing applications. Other terminals at key locations on campus include several medium-speed facilities and many typewriter-like and cathode ray tube devices used for faculty and student research and for instruction. An increasing number of departments in each of the eight schools utilize these facilities as an important tool in the total educational process.

The University Systems Analysis and Control Center provides centralized computing facilities for data acquisition, control and simulation built around an IBM System 7. The center maintains a versatile hybrid facility for faculty and student use. There are 17 hybrid simulation terminals for instruction. A PDP 11 40 is available for graphics, research and instruction. Various mini-computers, small analog computers, and a microprocessor laboratory are available for instruction and research.

INSTITUTE OF STATISTICS

The Institute of Statistics is composed of two sections, one at Raleigh and the other at Chapel Hill. At North Carolina State University, the Institute provides statistical consulting services to all branches of the institution, sponsors research in statistical theory and methodology, and coordinates the teaching of statistics at the undergraduate and graduate levels. The instructional and other academic functions are performed by the Department of Statistics, which forms a part of the Institute.

WATER RESOURCES RESEARCH INSTITUTE

The Water Resources Research Institute is a unit of the University of North Carolina System and is located on the campus of North Carolina State University.

The Institute was established to promote a multidisciplinary 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.

BIOLOGY FIELD LABORATORY

The Biology Field Laboratory is located eight miles from the University campus and comprises a 20-acre pond, 180 acres of extremely varied vegetation types and a modern laboratory building. The latter contains two laboratories, one for class use and another principally for research, and quarters for a married graduate student who serves as custodian of the property.

The many unique ecological situations found in this area make it ideal for use by advanced classes of most biological science departments. Likewise, the area is well adapted to a variety of research projects by faculty, graduate students and undergraduates because of its habitat diversity. The close proximity of the laboratory facility to the campus makes possible many types of behavioral, physiological, ecological, taxonomic and limnological studies that could be accomplished only with great difficulty at other locations.

ELECTRON MICROSCOPE CENTER

The facilities of the Electron Microscope Center are available to students and faculty within the University for research purposes and to those students who wish only to obtain a general knowledge of electron microscope techniques. A charge is assessed when the Center is used for research by faculty and graduate students.

The Center is located in Gardner Hall in a suite of rooms designed specifically for electron microscopy. Facilities of the Center include an ETEC U-1 scanning electron microscope, two transmission electron microscopes, a Siemens Elmskop 1A and a Hitachi HS 8 B, a specimen preparatory laboratory and a completely equipped darkroom.

Formal instruction is provided in electron microscopic cytological techniques, use of transmission and scanning electron microscopes, photographic techniques and interpretation of electron micrographs. Instructional tours are available for secondary education groups.

HIGHLANDS BIOLOGICAL STATION

North Carolina State University is an institutional member of the Highlands Biological Station, Inc., an inland biological field station located at Highlands, North Carolina. The town of Highlands is in the heart of the Southern Appalachians at an elevation of 3,823 feet. 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 botany, zoology, soils and geology. The laboratory building with research rooms and cubicles and the library are well equipped for field-oriented research. Also, four cottages and a dining hall are located on the edge of a six-acre lake. In addition to 16 acres surrounding the lake, the station owns several tracts of undisturbed forested land available for research. Research grants available through the station provide stipends for room, board and research expenses.

LEARNING CENTER

The Learning Center is an integral part of the research and development and service program of the School of Education.

Established in 1967, the Center is committed to seeking new ways and means for facilitating the intellectual growth and development of learners from early childhood through adulthood. Among the objectives of the Center is the development and implementation of experimental and demonstration projects which give promise of materially improving learning programs.

The Center is equipped with a variety of instruments to facilitate or train eye

movement for reading skill development. It provides tutorial services, by advanced students in several degree programs, to a limited number of learners.

NUCLEAR SERVICE FACILITIES

Specialized nuclear service facilities are available to the University faculty, students, 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 and pulse, pool-type, research reactor (PULSTAR) with a variety of test facilities; a 30,000 curie multipurpose cobalt-60 gamma irradiation source which includes a controlled environment support unit; intermediate hot laboratories with hoods, junior caves and glove boxes; a neutron activation analysis and radioisotope laboratory; NaI and solid-state detectors; counting and photographic rooms. The 50,000 sq. ft. Burlington Engineering Laboratories complex houses the Department of Nuclear Engineering and the Engineering Research Services Division with their associated offices and laboratories. All of the facilities including the reactor are on the North Carolina State University campus.

CENTER FOR OCCUPATIONAL EDUCATION

Established as a vocational education research and development center in 1965 under the provisions of the Vocational Education Act of 1963, the Center for Occupational Education is a unit within the School of Education. The Center was founded because occupational education problems are so varied that no single field of research or single disciplinary orientation is capable of providing all the answers. Studies and conferences in occupational education planning, work analysis, evaluation, labor and economics, adult education, personnel and leadership development, and education in rural areas have been included in the Center's program.

The major research and development programs of the Center are focused on the relationship of occupational education to its context or environment, including its relationship to regional economy, political influence, the power structure, and the employment or work environment. Currently, the Center's programmatic thrust is in the systematic application of information technology to the identification, collection, and provision of management information for occupational education decision-makers.

PESTICIDE RESIDUE RESEARCH LABORATORY

The Pesticide Residue Research Laboratory is a facility in the School of Agriculture and Life Sciences devoted to research on pesticide residues in animals, plants, soils, water and other entities of man's environment. Although the laboratory is administered through the Department of Entomology, it serves the total needs of the School in cooperative research projects requiring assistance on pesticide residue analyses.

The laboratory functions as a focal point for residue research involving inter-departmental cooperation, but faculty in the laboratory also conduct independent pesticide research on persistence and decomposition in soils and plants, absorption

and translocation in plants, distribution in environment, and contamination of streams, estuaries and ground water.

REPRODUCTIVE PHYSIOLOGY RESEARCH LABORATORY

The Reproductive Physiology Research Laboratory administered through the Department of Animal Science includes four environmental control rooms designed to provide constant levels of air temperature, humidity and light for animals involved in studies on reproduction. Facilities and equipment are available for surgery, *in vitro* growth of embryos, isotope labeling in embryo metabolism and transfer of embryos between females.

SOUTHEASTERN PLANT ENVIRONMENT LABORATORIES PHYTOTRONS

The Southeastern Plant Environment Laboratories operate as a cooperative association between North Carolina State University and Duke University with one unit, commonly called a phytotron, located on each campus. The laboratory is especially designed for research dealing with the response of biological organisms to their environment, and the high degree of control makes it possible to duplicate any climate from tropical rain forest to arid desert or arctic cold.

Research in the North Carolina State unit concentrates on 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 North Carolina State's graduate research program and to domestic and foreign visiting scientists.

TRIANGLE UNIVERSITIES NUCLEAR LABORATORY

TUNL is a laboratory for research in nuclear structure. It is located on the campus of Duke University in Durham and is staffed by faculty members and graduate students in the Departments of Physics of Duke University, the University of North Carolina at Chapel Hill and North Carolina State University. The principal tools of the laboratory are particle accelerators used to bombard target nuclei with an assortment of ions of accurately controlled energy and small energy spread.

Personnel of NCSU are participating partners in the maintenance and use of the laboratory. Collaboration with personnel from the other two participating universities is encouraged.

Schools, Departments, and Programs of Study

Undergraduate programs of study are offered by the School of Agriculture and Life Sciences, the School of Design, the School of Education, the School of Engineering, the School of Forest Resources, the School of Humanities and Social Sciences, the School of Physical and Mathematical Sciences, and the School of Textiles. The academic departments within each school have the primary responsibility for most of the programs of study. Some of the programs of study, however, are interdepartmental, and some are interschool. The requirements for completion of all programs of study reflect general university and school requirements as well as the particular requirements of a department or discipline.

Throughout this section the requirements are frequently shown as particular courses or categories of courses. The course prefix codes shown on pages 209-210 will provide a key for locating the basic information for each individual course in the Course Description section.



The D. H. Hill Library with its million volumes and the University Plaza are prominent features of the central campus.

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

Patterson Hall

J. E. Legates, *Dean*

E. W. Glazener, *Associate Dean and Director of Academic Affairs*

Modern agriculture is a complex industry built on the principles of science and business. The basic sciences are the foundations for modern agricultural technology. These sciences applied to understanding the functions of living material offer a background as preparation for a professional agriculturist, environmentalist, or as a preparatory program for the medical and health-related sciences. Likewise, the principles of economics and sociology provide background preparation for agricultural business management and public service aspects of society.

The objectives of the academic program are as follows:

- 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, sufficient for initial employment
- 4) To provide background for graduate or professional programs

A high percentage of all the gainfully employed persons in the United States are engaged in operations directly or indirectly related to food and fiber. For example, the food industry ranges from those who produce the food, supply material to the producer, and process the finished product to those who sell the products to the consumer. Hundreds of distinct occupations are represented in modern agriculture and biology. About 30 percent of the graduates elect to continue their education in graduate and professional schools.

STUDENT ACTIVITIES

Students in the School of Agriculture and Life Sciences have ample opportunities to take part in broadening extracurricular activities. Most departments have student organizations which provide professional as well as social experience. Representatives of these clubs form the Agri-Life Council. This council is the student organization representing the school. Student tours provide an opportunity to see firsthand the application of classroom principles. In addition, students representing 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.

CURRICULA OFFERINGS AND REQUIREMENTS

A freshman enrolling in agriculture and life sciences has a common core of courses the first year, courses that are 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 an interdisciplinary program or an individualized course plan. All departments offer the science curricula; several the technology curricula. The business curriculum is offered in agricultural economics in the Department of Economics and Business.

Departmental majors are offered as follows:

Science—agricultural economics, animal science, biological and agricultural engineering (joint program with the School of Engineering), botany, crop science, entomology, food science, horticultural science, medical technology, poultry science, rural sociology, soil science, wildlife biology and zoology. Premedical sciences are offered in this curriculum.

Technology—biological and agricultural engineering, animal science, food science, horticultural science and poultry science.

Business—agricultural economics in the Department of Economics and Business. Opportunity for double majoring in business and other programs is available.

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

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

Conservation A curriculum concentrating on the use, preservation and improvement of natural resources. Administered jointly by the School of Agriculture and Life Sciences and the School of Forest Resources.

Pest Management for Crop Protection A curriculum with emphasis on the application of chemical and biological principles in the control of plant diseases, insects and weeds. The curriculum is administered by the Departments of Crop Science, Entomology, Horticultural Science and Plant Pathology.

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.

Individualized Study Program A curriculum planned by the student with the assistance of a faculty advisory committee.

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

HONORS PROGRAM

The School of Agriculture and Life Sciences has a comprehensive Honors Program for qualified freshmen and sophomores interested in participating in seminar discussion programs on broad topics. These sessions are led by outstanding professors.

Qualified juniors and seniors have an opportunity to participate in an independent research program. Faculty direction is provided on an individual basis to each student. The student has the opportunity to select his project.

INTERNATIONAL ASPECTS

An International Seminar is offered to interested students. In addition, an International Option, requiring modern 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 school.

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

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, marine sciences, microbiology, nutrition, physiology, plant pathology, sociology, soil science, and zoology.

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

OPPORTUNITIES

Broad and fascinating opportunities in business, industry, education and government are open to graduates of this school. Some of the areas in which graduates are employed are as follows:

Business and Industry banking and credit, insurance, farm management, cooperatives, land appraisal, marketing, transportation, food chains, food processing and distribution, machinery and equipment, chemicals, fertilizer, feed manufacturing, seed improvement.

Communications writing, reporting, radio, television, newspapers, magazines, advertising, publications.

Conservation soil, water, range, forest, fish, wildlife parks, recreation.

Education high school and college instruction in agriculture, biology, agricultural extension, governmental and industrial agencies.

Farming and Ranching (agricultural production) general livestock, field crops, fruits, vegetables, poultry, ornamentals.

Preprofessional and Graduate Preparation premedical programs for training for medical, dental and veterinary colleges; graduate programs.

Research production, marketing, engineering, processing, biological sciences, conservation, organizational structure, group behavior.

Services inspection and regulation, production field service, health services, environmental quality, product standards, grading, agricultural technology and consulting.

A placement office, coordinated with the University Career Planning and Placement Center, is maintained to assist graduates in career development and placement.

FRESHMAN YEAR

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

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ALS 103 Introductory Topics in ALS	1	ENG 112 Composition and Reading	3
BS 100 General Biology or CH 101		MA 112 Analytic Geometry and Calculus A	4
ENG 111 Composition and Rhetoric	4	or	
Social Science and Humanities Elective	3	MA 114 Introduction to Finite Mathematics with Applications	3
MA 111 Algebra and Trigonometry**	4	Social Science and Humanities Elective	3
Physical Education	1	CH 101 General Chemistry I or CH 107 Principles of Chemistry	
(Military Science or Air Science may be elected)		or	
	16	BS 100 General Biology	4
		Physical Education	1
		(Military Science or Air Science may be elected)	
			14-15

*Both Biology and Chemistry are required for all ALS curricula.

**Does not contribute to the 130 semester hours required in the biological sciences curriculum.

CURRICULA IN AGRICULTURE AND LIFE SCIENCES*

Science, technology and business are three curricula offered in this school. All departments offer the science curriculum. Several departments offer the choice of either science or technology. In addition, several departments are participating in interdisciplinary programs.

A business curriculum is offered in agricultural economics. Double majors between agricultural economics and other subject areas may be arranged.

All the curricula have a core of required courses on a school basis. Courses peculiar to a specific department are listed under the departmental requirements. Listed on the following pages are the required courses by curriculum on a school basis.

* Group A includes the physical and biological sciences; Group B, economics and business management; Group C, applied science and technology; Group D, social sciences and humanities.

SCIENCE

<i>Credits</i>	<i>Physical and Biological Sciences (31 Credits)</i>	
ALS 103 Introductory Topics in ALS	1	
<i>Language (12 Credits)</i>		
ENG 111 Composition and Rhetoric	3	
ENG 112 Composition and Reading	3	
Electives (English or Modern Language)	6	
<i>Social Sciences and Humanities (21 Credits)</i>		
Electives from Group D	21	
	BS 100 General Biology	4
	Biological Sciences Elective	1
	CH 101 General Chemistry I	4
	CH 103 General Chemistry II	4
	or	
	CH 107 Principles of Chemistry	4
	MA 111 Algebra and Trigonometry	4
	MA 112 Analytic Geometry and Calculus A	4
	or	

MA 114	Introduction to Finite Mathematics with Applications	3
PY 221	College Physics	5
PY 211, PY 212	General Physics	8

<i>Electives (80 & Credits)</i>	
Restricted Electives from Group A	22-26
Departmental Requirements and Electives	26
Free Electives	12
Subtotal	126
Physical Education	4
Hours Required for Graduation	130**

BUSINESS

(See Department of Economics and Business under School of Agriculture and Life Sciences)**

TECHNOLOGY

<i>Credits</i>		
ALS 103	Introductory Topics in ALS	1
<i>Language (12 Credits)</i>		
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
SP 110	Public Speaking	3
Electives (English or Modern Language)		3
<i>Social Sciences and Humanities (21 Credits)</i>		
Electives from Group D		21
<i>Physical and Biological Sciences (23 Credits)</i>		
BS 100	General Biology	4
Biological Sciences Elective		4
CH 101	General Chemistry I	4
CH 103	General Chemistry II	4
or		
CH 107	Principles of Chemistry	4

MA 111	Algebra and Trigonometry	4
MA 112	Analytic Geometry and Calculus A	4
or		
MA 114	Introduction to Finite Mathematics with Applications	3
PY 221	College Physics	5
SSC 200	Soil Science	4

<i>Electives (59-60 Credits)</i>	
Restricted Electives from Groups A, B or C	20-21
Departmental Requirements and Electives	27
Free Electives	12
Subtotal	126
Physical Education	4
Hours Required for Graduation	130**

** All curricula require the completion of one course in literature.

ELECTIVES

The following lists provide typical courses that are elected from the four block groupings A, B, C and D. Additional courses may be selected by checking with the office of the Director of Academic Affairs.

Group A

PHYSICAL AND BIOLOGICAL SCIENCES

Animal Sciences

ANS 401	Reproductive Physiology
ANS 405	Lactation
ANS (NTR, PO) 415	Comparative Nutrition
ANS (PHY) 502	Reproductive Physiology of Vertebrates
ANS (GN) 508	Genetics of Animal Improvement
ANS (NTR) 516	Quantitative Nutrition
ANS (PHY) 580	Mammalian Endocrine Physiology

*Biochemistry**

BCH 351	Elementary Biochemistry
BCH 352	Elementary Biochemistry Laboratory
BCH 551	General Biochemistry
BCH 552	Experimental Biochemistry

BCH (PHY) 553	Physiological Biochemistry
BCH 554	Radioisotope Techniques in Biology
BCH (GN, MB) 561	Biochemical and Microbial Genetics

Biological and Agricultural Engineering

BAE 303	Energy Conversion in Biological Systems
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Biological Sciences

All courses listed with the BS designation.

*Bioinformatics**

All Courses

Botany

BO 200 Plant Life
BO (ZO) 360 Introduction to Ecology
BO 400 Plant Diversity
BO 403 Systematic Botany
BO 413 Introductory Plant Anatomy
BO (ZO) 414 Cell Biology
BO 421 Plant Physiology
BO 480 Air Pollution Biology
BO 565 Plant Community Ecology
BO 570 Quantitative Ecology
BO (MB) 574 Phycology
BO (MB, PP) 575 The Fungi
BO (MB, PP) 576 The Fungi Laboratory

*Chemistry**

All Courses

*Computer Science**

All Courses

Entomology

ENT 301 Introduction to Forest Insects
ENT 312 Introduction to Economic Insects
ENT (ZO) 425 General Entomology
ENT 502 Insect Diversity
ENT 503 Functional Systems of Insects
ENT 570 Behavior of Insects

Food Science

FS 331 Food Engineering
FS 402 Food Chemistry
FS-(MB) 405 Food Microbiology
FS 503 Food Analysis
FS 504 Food Proteins and Enzymes
FS 506 Advanced Food Microbiology

Forestry

FOR 273 Quantitative Methods in Forest Resources

*Geosciences**

All Courses

Genetics

GN 411 The Principles of Genetics
GN 412 Elementary Genetics Laboratory
GN 504 Human Genetics
GN (ANS) 508 Genetics of Animal Improvement
GN (ZO) 532 Biological Effects of Radiations
GN (ZO) 540 Evolution
GN (ZO) 550 Experimental Evolution
GN (BCH, MB) 561 Biochemical and Microbial Genetics

*Mathematics**

All Courses

*Metereology**

All Courses

Microbiology

MB 401 General Microbiology
MB (FS) 405 Food Microbiology
MB 501 Advanced Microbiology
MB 514 Microbial Metabolism
MB 551 Immunology I
MB (BCH, GN) 561 Biochemical and Microbial Genetics
MB 571 Virology
MB (BO) 574 Phycology

MB (BO, PP) 575 The Fungi
MB (BO, PP) 576 The Fungi-Laboratory

Nutrition

NTR (ANS, PO) 415 Comparative Nutrition
NTR (ANS) 516 Quantitative Nutrition

*Physics**

All Courses

Physiology

PHY (ANS) 502 Reproductive Physiology of Vertebrates
PHY (BCH) 553 Physiological Biochemistry
PHY (ANS) 580 Mammalian Endocrine Physiology

Plant Pathology

PP (BO, MB) 575 The Fungi
PP (BO, MB) 576 The Fungi Laboratory

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

*Statistics**

All Courses

Zoology

ZO 201 General Zoology
ZO 202 Invertebrate Zoology
ZO 203 Vertebrate Zoology
ZO 212 Basic Anatomy and Physiology
ZO 315 General Parasitology
ZO 323 Comparative Anatomy
ZO 345 Histology
ZO (BO) 360 Introduction to Ecology
ZO 361 Vertebrate Embryology
ZO (BO) 414 Cell Biology
ZO 415 Cellular and Animal Physiology Laboratory
ZO 420 Fishery Science
ZO 421 Vertebrate Physiology
ZO (ENT) 425 General Entomology
ZO 441 Ichthyology
ZO 442 Ichthyology Laboratory
ZO 510 Adaptive Behavior of Animals
ZO 513 Comparative Physiology
ZO 515 Growth and Reproduction of Fishes
ZO 517 Population Ecology
ZO (PO) 524 Comparative Endocrinology
ZO (GN) 532 Biological Effects of Radiations
ZO (GN) 540 Evolution
ZO (GN) 550 Experimental Evolution

* Courses in these blocks are considered Physical Sciences.

Group B

ECONOMICS AND BUSINESS

Accounting

ACC 260 Accounting I Concepts of Financial Reporting

ACC 261 Accounting II Financial Information Systems
 ACC 262 Managerial Uses of Cost Data
 ACC 360 Financial Reporting Theory and Practice I
 ACC 361 Financial Reporting Theory and Practice II
 ACC 362 Production Cost Analysis and Control
 ACC 364 An Introduction to Income Taxation
 ACC 460 Specialized Financial Reporting Theory and Practice
 ACC 465 Advanced Income Taxation
 ACC 466 Examination of Financial Statements
 ACC 468 Professional Accountancy Resumes

Biological and Agricultural Engineering

BAE 461 Analysis of Agricultural System

Economics and Business

EB 230 Economics of Cooperatives
 EB 303 Farm Management
 EB 307 Business Law I
 EB 308 Business Law II
 EB 310 Economics of the Firm
 EB 311 Agricultural Markets
 EB 313 Marketing Methods
 EB 325 Industrial Management
 EB 326 Personnel Management
 EB 332 Industrial Relations
 EB (ST) 350 Economics and Business Statistics
 EB 401 Economic Analysis for Non Majors
 EB 404 Money, Financial Markets and the Economy
 EB 410 Public Finance
 EB 413 Competition, Monopoly and Public Policy
 EB 415 Farm Appraisal and Finance
 EB 420 Corporation Finance
 EB 422 Investments and Portfolio Management
 EB 430 Agricultural Price Analysis
 EB 431 Labor Economics
 EB 435 Urban Economics
 EB 436 Environmental Economics
 EB 448 International Economics
 EB 485 Management Development Seminar

Mathematics

MA 122 Mathematics of Finance

Statistics

ST (EB) 350 Economics and Business Statistics

Group C

APPLIED SCIENCE AND TECHNOLOGY

Agricultural Communications

AC 311 Communication Methods and Media

Animal Science

ANS 200 Introduction to Animal Science
 ANS 204 Livestock Feeds and Feeding
 ANS (FS, NTR) 301 Nutrition and Man
 ANS 302 Livestock and Dairy Eval.
 ANS 308 Advanced Selection Dairy and Meat Animals
 ANS 402 Beef Cattle Management
 ANS 403 Swine Management
 ANS 404 Dairy Cattle Management
 ANS 406 Sheep Management
 ANS (FS) 409 Meat and Meat Products
 ANS 410 Horse Management
 ANS 411 Breeding and Improvement of Domestic Animals
 ANS (VET) 420 Diseases of Farm Animals
 ANS 510 Advanced Livestock Management
 ANS 520 Tropical Livestock Production

Biological and Agricultural Engineering

BAE 201 Shop Practices
 BAE 211 Farm Machinery
 BAE 251 Elements of Biological and Agricultural Engineering
 BAE (SSC) 321 Water Management
 BAE 322 Farm Structures
 BAE 341 Farm Electrifications and Utilities
 BAE 411 Farm Power and Machinery
 BAE 433 Processing Agricultural Products
 BAE (SSC) 471 Agricultural Water Management
 BAE (CE) 578 Agricultural Waste Management

Civil Engineering

CE (BAE) 578 Agricultural Waste Management

Crop Science

CS 211 Crop Science
 CS 214 Crop Science Laboratory
 CS 312 Pastures and Forage Crops
 CS 315 Turf Management
 CS 411 Environmental Aspects of Crop Production
 CS 413 Plant Breeding
 CS 414 Weed Science
 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

Entomology

ENT 201 Insects and Man
 ENT 203 Introduction to the Honey Bee and Beekeeping
 ENT 550 Fundamentals of Insect Control
 ENT 562 Agricultural Entomology
 ENT (ZO) 582 Medical and Veterinary Entomology

Food Science

FS 201 Food Science and Man's Food
 FS (ANS, NTR) 301 Nutrition and Man
 FS 400 Foods and Nutrition
 FS (PO) 404 Poultry Products
 FS (ANS) 409 Meat and Meat Products

Genetics

GN 301 Genetics in Human Affairs
 GN (PO) 520 Poultry Breeding

Horticultural Sciences

HS 101 Plants for Home and Pleasure
 HS 201 Principles of Horticulture
 HS 301 Plant Propagation
 HS 342 Landscape Horticulture
 HS 352 Landscape Design Presentation
 HS 411 Nursery Management
 HS 421 Tree Fruit Production
 HS 422 Small Fruit Production
 HS 432 Vegetable Production
 HS 440 Greenhouse Management
 HS 441 Floriculture I
 HS 442 Floriculture II
 HS 471 Arboriculture
 HS (CS) 514 Principles and Methods in Weed Science
 HS 531 Physiology of Landscape Plants

Nutrition

NTR (ANS, FS) 301 Nutrition and Man

Pest Management

PM 111 Introduction to Integrated Pest Management
 PM 415 Principles of Pest Management

Plant Pathology

- PP 310 Diseases of Fruit Crops
- PP 311 Diseases of Vegetable Crops
- PP 312 Diseases of Woody Ornamentals and Turf Grasses
- PP 313 Diseases of Herbaceous Ornamentals
- PP 314 Diseases of Field Crops
- PP 315 Plant Diseases
- PP 318 Forest Pathology
- PP 450 Nematode Diseases of Plants and Their Control
- PP 500 Plant Disease Control
- PP 505 Histopathology

Poultry Science

- PO 201 Poultry Science and Production
- PO 301 Evaluation of Live Poultry
- PO 351 Grading and Evaluation of Poultry Products
- PO (VET) 401 Poultry Diseases
- PO (FS) 404 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

Group D

SOCIAL SCIENCES AND HUMANITIES

The student is required to complete 21 hours of Group D courses in all degree programs. Not more than six semester hours are to come from one department, and only one speech or writing course can be used as a Group D elective. It is strongly recommended that the student take at least one course in each of the three major areas outlined below. A course in economics and a course in sociology are also highly recommended.

AREA I

Anthropology

All Courses

Economics

- EB 201 Economics I
- EB 202 Economics II
- EB 212 Economics of Agriculture
- EB 301 Production and Prices
- EB 302 Aggregate Economic Analysis
- EB (HI) 370 The Rise of Industrialism
- EB (HI) 371 Evolution of the American Economy
- EB 442 Evolution of Economic Ideas
- EB 475 Comparative Economic Systems

Psychology and Sociology

All Courses

AREA II

History, Political Science, and University Studies

All Courses

- PO 423 Broiler Production
- PO (GN) 520 Poultry Breeding

Soil Science

- SSC 205 Soils as a Natural Resource
- SSC BAE 221 Water Management
- SSC 341 Soil Fertility and Fertilizers
- SSC 352 Soil Classification
- SSC 461 Soil Physical Properties and Plant Growth
- SSC (CS) 462 Soil Crop Management Systems
- SSC BAE 471 Agricultural Water Management
- SSC 472 Forest Soils

Veterinary Science

- VET 300 Laboratory Animal Management
- VET (PO) 401 Poultry Diseases
- VET (ANS) 420 Diseases of Farm Animals

Zoology

- ZO 221 Conservation of Natural Resources
- ZO 353 Wildlife Management
- ZO 400 Biological Basis of Man's Environment
- ZO (ENT) 582 Medical and Veterinary Entomology

AREA III

Art and Music

Courses numbered 200 and above

Communications

* All speech and writing courses

English

All literature courses

Foreign Languages

Courses numbered 200 and above

Philosophy and Religion

All Courses

* Only one course in speech or writing may be used in fulfillment of this request.

ADULT AND COMMUNITY COLLEGE EDUCATION

(See Education.)

AGRONOMY

Professor D. A. Emery, Coordinator of Advising Crop Science

Professor M. G. Cook, Coordinator of Advising Soil Science

Students may earn a Bachelor of Science degree under the technology curriculum of Agricultural and Life Sciences with a major in agronomy. The agronomy option is administered jointly by the Departments of Crop Science and Soil Science. For further information, see crop science or soil science.

CURRICULUM IN CROP SCIENCE AND SOIL SCIENCE

TECHNOLOGY (AGRONOMY) 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	
SP 110	Public Speaking	3	
	Literature Elective	3	
	<i>Social Sciences and Humanities (21 Credits)</i>		
Electives		21	
	<i>Physical and Biological Sciences (32-33 Credits)</i>		
MA 111	Algebra and Trigonometry	4	
MA 112	Analytic Geometry and Calculus A	4	
	or		
MA 114	Introduction to Finite Mathematics with Applications	3	
CH 101	General Chemistry I	4	
CH 103	General Chemistry II	4	
FY 221	College Physics	5	
BS 100	General Biology	4	
SSC 200	Soil Science	4	
BD 421	Plant Physiology	4	
	<i>Physical Education</i>		
Physical Education		4	
	<i>Free Electives</i>		
Free Electives		12	
	<i>Group A,B,C Courses (19-20 Credits)</i>		
CH 220	Introductory Organic Chemistry	4	
GN 411	The Principles of Genetics	3	
PP 312	Diseases of Woody Ornamentals and Turf Grasses	1	
	or		
PP 314	Diseases of Field Crops	1	
PP 315	Plant Diseases	3	
Electives in A, B, or C Courses		8-9	
	<i>Departmental Requirements (28 Credits)</i>		
CS 211	Crop Science	4	
CS 214	Crop Science Laboratory	1	
CS 312	Pastures and Forage Crops	3	
	or		
CS 315	Turf Management	3	
CS 411	Environmental Aspects of Crop Production	2	
CS 413	Plant Breeding	2	
CS 414	Weed Science	4	
CS 490	Senior Seminar in Crop Science	1	
	or		
SSC 492	Senior Seminar in Soil Science	1	
SSC 341	Soil Fertility and Fertilizers	3	
SSC 342	Soil Fertility Laboratory	1	
SSC 352	Soil Classification	4	
SSC (CS) 462	Soil-Crop Management Systems	3	
Hours Required for Graduation		130	

ANIMAL SCIENCE

Polk Hall

Professor C. A. Lassiter, Head of the Department

Professor R. M. Myers, Coordinator of Advising

TEACHING AND RESEARCH

Professors: E. R. Barrick, A. J. Clawson, D. G. Davenport, F. J. Eissen, L. Goode, R. W. Harvey, E. E. Jones, J. M. Leatherwood, J. G. Lecce, J. E. Legates, B. T. McDaniel, R. D. Mochrie, R. M. Myers, I. D. Porterfield, A. H. Rakes, H. A. Ramsen, O. W. Robson, L. C. Ulberg. *Professors Emeriti:* F. H. Smith, H. A. Stewart, G. H. Wiser. *Associate Professors:* J. H. Britz, E. V. Caruolo, E. U. Dillard, B. H. Johnson, W. L. Johnson, J. J. McNeill, J. C. Wilk. *Assistant Professors:* W. D. Armstrong, J. C. Cornwell, W. J. Croom. *Adjunct Assistant Professor:* B. D. Harrington. *Associate Members of the Faculty:* J. C. Burns. *Crop Science:* S. B. Tove. *Biochemistry:* C. H. Hill. *Poultry Science:* E. G. Batte, D. J. Moncol. *Veterinary Science:*

EXTENSION

Professor J. W. Patterson, In Charge, Animal Husbandry Extension

Professor G. S. Parsons, In Charge, Dairy Husbandry Extension

Professor D. G. Spruill, In Charge, Swine Husbandry Extension

Professors: R. F. Behlow, T. C. Blalock, J. R. Jones, F. D. Sargent, J. R. Woodard. *Extension Professors Emeriti:* A. V. Allen, J. S. Buchanan, G. Hyatt, Jr., M. E. Senger. *Associate Professors:* K. R. Butcher, F. N. Knott, C. M. Stanslas, D. P. Wesen. *Assistant Professors:* R. G. Crickenberger, T. M. Leonard, D. G. Lewis, H. W. Webster, III, M. D. Whitacre. *Assistant Professor Emeriti:* R. R. Rich. *Extension Specialists:* B. C. Allison, J. K. Butler, J. H. Gregory, J. W. Parker. *Extension Specialists Emeriti:* J. A. Arey, R. L. Wynne.

Undergraduate students study subjects related to various phases of animal industry. Training is provided in nutrition, physiology, breeding and disease 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 training.

OPPORTUNITIES

Opportunities for animal science majors include farm, dairy and livestock management careers, jobs as fieldmen for breed association and livestock organizations, agricultural extension, education work in business and industries serving agriculture, meat grading, agricultural communications in animal science, feed manufacturing, sales work in feeds and equipment, marketing dairy cattle and dairy products, and supervising livestock and farm loans with banks and lending agencies. Many students in veterinary science obtain degrees in animal science as well. Students may elect graduate study, after which they will find opportunities in teaching, research and development. See listing of graduate degrees offered.

UNDERGRADUATE CURRICULA

The degree of Bachelor of Science with a major in animal science may be obtained under either the science or technology curricula offered in Agriculture and Life Sciences. For the basic requirements and freshman year refer to those sections under School of Agriculture and Life Sciences.

CURRICULA IN ANIMAL SCIENCE

SCIENCE PROGRAM

ALS 103	Introductory Topics in ALS	1
<i>Languages (12 Credits)</i>		
ENG 111	Composition and Rhetoric	4
ENG 112	Composition and Reading	3
	Literature Elective	4
SP 110	Public Speaking	3
<i>Sciences, Arts and Humanities (12 Credits)</i>		
Electives		21
Group D	Recommended including EB 212 and EB 202	

Physical and Biological Sciences

MA 111	Algebra and Trigonometry	4
MA 112	Analytic Geometry & Calculus A or MA 113 Introduction to Calculus or MA 114, Introduction to Finite Math	4 or 3
CH 101	General Chemistry I	4
CH 107	Principles of Chemistry	4
PY 221	College Physics or PY 211 & 212, General Physics	5 or 8
BS 100	General Biology	4
ZO 421	Vertebrate Physiology	3

Physical Education

Physical Education	4
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Free Electives

Free Electives	12
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Group A, B, C Courses (29 Credits)

CH 221	Organic Chemistry I	4
CH 223	Organic Chemistry II	4
GN 411	The Principles of Genetics	3
MB 401	General Microbiology	4
Electives in A, B or C Courses (only 6 may be B or C) Recommended including BCH 351		14

Departmental Requirements and Electives (23 Credits)

ANS 200	Introduction to Animal Science	4
ANS 204	Livestock Feeds and Feeding	3
ANS 490	Seminar in Animal Science	1
Animal Science Electives as follows:		15
A minimum of 9 credits from:		
ANS 401, 405, 411, 415, VET 420	9	
A minimum of 6 credits from:		
ANS 302, 402, 403, 404, 406, 410	6	
Hours Required for Graduation		130

TECHNOLOGY PROGRAM

ALS 103	Introductory Topics in ALS	Credits 1
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Languages (12 Credits)

ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
SP 110	Public Speaking	3
Literature Elective		3

Social Sciences and Humanities (21 Credits)

Electives (Group D) Recommend including EB 212 and EB 202	21
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Physical and Biological Sciences

MA 111	Algebra and Trigonometry	4
MA 112	Analytic Geometry & Calculus A or MA 113 Introduction to Calculus or MA 114, Introduction to Finite Math	4 or 3
CH 101	General Chemistry I	4
CH 103	General Chemistry II or CH 107, Principles of Chemistry	4
PY 221	College Physics or PY 211 & 212, General Physics	5 or 8
BS 100	General Biology	4
ZO 421	Vertebrate Physiology	3
SSC 200	Soil Science	4

Physical Education

Physical Education	4
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Free Electives

Free Electives	12
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*Group A, B, C Courses (22-23 Credits)**

CH 220	Introductory Organic Chemistry	4
GN 411	The Principles of Genetics	3
Electives in A, B, or C Courses		15-16

Departmental Requirements and Electives (26 Credits)

ANS 200	Introduction to Animal Science	4
ANS 204	Livestock Feeds and Feeding	3
ANS 490	Seminar in Animal Science	1
Animal Science Electives as follows:		
A minimum of 9 credits from:		
ANS 401	Reproductive Physiology	3
ANS 405	Lactation	3
ANS 411	Breeding and Improvement of Domestic Animals	3
ANS (NTR, PO) 415	Comparative Nutrition	3
ANS (VET) 420	Diseases of Farm Animals	3 (9)
A minimum of 9 credits from:		
ANS 302	Livestock and Dairy Evaluation	2
ANS 402	Beef Cattle Management	3
ANS 403	Swine Management	3
ANS 404	Dairy Cattle Management	3
ANS 406	Sheep Management	3
ANS 410	Horse Management	3 (9)
Hours Required for Graduation		130

* Dependent upon whether MA 112 or MA 113 or MA 114 was elected.

BIOCHEMISTRY

Polk Hall

Professor S. B. Tove, Head of the Department

Professor F. B. Armstrong, Coordinator of Advising

Professors: H. R. Horton, J. S. Kahn, I. S. Longmuir, A. R. Main; Associate Professors: J. A. Knopp, E. C. Sister, E. C. Theil, Assistant Professor: W. L. Miller; Associate Members of the Faculty: E. E. Jones (Animal Science), L. W. Aurand, H. E. Swaisgood (Food Science), J. Bordner (Chemistry)

The Department of Biochemistry offers instruction at the undergraduate and graduate levels. Undergraduate courses provide students from a number of curricula with a fundamental background in biochemistry.

UNDERGRADUATE CURRICULUM

The undergraduate curriculum leads to the Bachelor of Science degree in the biological sciences with an option in biochemistry.

BIOLOGICAL SCIENCES CURRICULUM (BIOCHEMISTRY OPTION)

	<i>Orientalia</i>	<i>Credits</i>
ALS 109	Introductory Topics in ALS	1
<i>Languages (12 Credits)</i>		
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
FL	Foreign Language	6
<i>Social Sciences and Humanities (21 Credits)</i>		
Electives		21
<i>Mathematical Sciences (12-19 Credits)†</i>		
MA 112	Analytic Geometry and Calculus A	4
or MA 102*	Analytic Geometry and Calculus I	
MA 212	Analytic Geometry and Calculus B	3-4*
or MA 201*	Analytic Geometry and Calculus II	
MA 114	Introduction to Finite Mathematics with Applications	3-4*
or MA 202*	Analytic Geometry and Calculus III	
MA 301*	Applied Differential Equations I	3*
CSC, ST, or MA	Elective in Computer Science, Statistics, or Mathematics	2-3

Physical Education	4
<i>Physical and Biological Sciences (61-78 Credits)†</i>	
CH 101 General Chemistry I	4
CH 107 Principles of Chemistry	4
CH 221, 223 Organic Chemistry I and II	4, 4
CH 315 Quantitative Analysis	4
or CH 428* Qualitative Organic Analysis	4 or 3*
CH 331 Introductory Physical Chemistry	4
or CH 431*, 433* Physical Chemistry I and II	4 or 3*, 3*
BS 100 General Biology	4
BO 200 Plant Life	4
ZO 201 General Zoology	4
BO (ZO) 360 Introduction to Ecology	4
BO 421 Plant Physiology	4
or ZO 414 Cell Biology	4
or ZO 421 Vertebrate Physiology	3-4
BCH 351 Elementary Biochemistry	3
BCH 551* General Biochemistry	3*
BCH 352 Elementary Biochemistry Laboratory	3
or BCH 552* Experimental Biochemistry	2 or 3*
PY 211, 212 General Physics	4, 4
or PY 205*, 208* General Physics	or 4*, 4*
MB 401 General Microbiology	4
GN 411 The Principles of Genetics	3
GN 412 Elementary Genetics Laboratory	1
ALS 499* Honors Research	3*
or BCH 490* Special Studies in Biochemistry	3*
<i>Free Electives (Up to 15 Credits)</i>	
Electives	0-15
Hours Required for Graduation	130

† The grade "D" will not be accepted as a passing grade in any mathematics or science courses.

* Courses required for the Honors Program in Biochemistry; recommended for students preparing for graduate study in Biochemistry.

BIOLOGICAL AND AGRICULTURAL ENGINEERING

(Also see Engineering.)

David S. Weaver Laboratories

Professor F. J. Hassler, Head of Department

Professor G. B. Blum Jr., Coordinator of Advising

TEACHING AND RESEARCH

Professors: G. B. Blum Jr., H. D. Bowen, J. W. Dickens (USDA), J. M. Fore, E. L. Howell, B. K. Huang, E. G. Humphries, W. H. Johnson, G. J. Kris, W. F. McClure, R. P. Rohrback, C. W. Suggs, T. B. Whitaker (USDA), E. H. Wiser, J. H. Young
Professors Emeriti: D. H. Howells, C. W. Giles, J. W. Weaver Jr.; *Associate Professors:* C. F. Abrams, G. R. Baughman, M. R. Overcash, R. W. Shoggs, R. S. Sowell; *Assistant Professors:* P. W. Westerman, D. H. Willis Jr., D. W. Winter (USDA); *Adjunct Asst. Professor:* G. M. Jividen; *Associate Members of the Faculty:* D. D. Hamann, V. A. Jones (Food Science), A. E. Hassan (Forestry)

EXTENSION

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

Professor: L. B. Driggers; *Professor Emeritus:* H. M. Ellis; *Associate Professors:* E. O. Beasley, J. W. Glover, R. E. Sneed, R. W. Watkins; *Associate Professor Emeritus:* J. C. Ferguson, W. C. Warrick; *Assistant Professor:* J. C. Barker

Biological and agricultural engineering students train to deal with problems of agriculture that are engineering in nature. Scientific and engineering principles are applied to the con-

servation and utilization of water and soil, the development of power and labor-saving devices for all phases of agricultural production, the design of structures and equipment for housing and handling livestock and field products, and the processing and marketing of farm products.

Two curricula are offered, technology and science, which are explained below. Science graduates receive a B.S. in biological and agricultural engineering. Technology students receive the B.S. in agriculture.

OPPORTUNITIES

Graduates of the science curriculum are qualified for positions in design, development and research in public institutions and in industry, and for teaching and extension work in institutions of higher education. This curriculum, accredited by the Engineering Council for Professional Development, also provides adequate training for post-graduate work leading to advanced degrees. See listing of graduate degrees offered.

Those trained in agricultural engineering technology are qualified for positions in sales and service of agricultural equipment such as farm machinery, irrigation systems, etc.; as county agents or farmers; and for farm advisory work with such organizations as electric power companies.

CURRICULA IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

SCIENCE PROGRAM

The science curriculum develops young people capable of engineering leadership in agriculture. Emphasis is placed on basic science courses such as mathematics, physics, mechanics, biology, soils, and thermodynamics, which provide a sound background for engineering and agricultural technology. Courses are directed to those methods of thought and techniques whereby science can be applied with understanding and judgment to engineering situations related to agricultural operations.

Since biological and agricultural engineering involves two distinct technical fields agriculture and engineering—the science curriculum is a joint responsibility of Agriculture and Life Sciences and Engineering and is so administered. Undergraduate students in this curriculum may officially enroll in either school; duplicate undergraduate records are maintained in both schools.

For the program in agricultural engineering science, refer to the freshman year and the curriculum in the School of Engineering.

TECHNOLOGY PROGRAM

The technology curriculum is for those who wish to work at the applied level in the agribusiness complex. Graduates are equipped to apply to the farm the new technology as developed and revealed by the professional agricultural engineer. The courses are presented and directed toward the solution of consumer problems with emphasis on the techniques employed.

Listed below are the departmental requirements in the technology program.

ALS 103	Introductory Topics in ALS	Credits 1		
	<i>Languages (12 Credits)</i>			
ENG 111	Composition and Rhetoric	3	MA 111	Algebra and Trigonometry
ENG 112	Composition and Reading	3	MA 111	Introduction to Finite Mathematics with Applications
SP 110	Public Speaking	3		3
Literature Elective		3		<i>or</i>
	<i>Social Sciences and Humanities (21 Credits)</i>		MA 112	Analytical Geometry and Calculus A
Group D Electives		18	CH 101	General Chemistry I
EB 212	Economics of Agriculture	3	CH 103	General Chemistry II
			BS 100	General Biology
				Biological Science Elective
				1

<i>Physical Education (4 Credits)</i>	
PE 100 Health and Physical Fitness	1
Physical Education	3
<i>Free Electives (12 Credits)</i>	
Free Electives	12
<i>Group A, B, C Courses (27 or 26 Credits)</i>	
PY 211 General Physics	4
PY 212 General Physics	4
CSC 200 Introduction to Computers and Their Uses	3
SSC 200 Soil Science	4
Management Elective	3
Electives in A, B, or C Courses	8 or 9

<i>Departmental Requirements and Electives (30 Credits)</i>	
E 101 Engineering Graphics I	2
BAE 201 Shop Practices	2
BAE 211 Farm Machinery	3
BAE 321 Water Management	4
BAE 341 Farm Electrification and Utilities	4
BAE 433 Processing Agricultural Products	4
BAE 461 Analysis of Agricultural Systems	3
BAE 332 Farm Structures	3
BAE 411 Farm Power and Machinery	3
BAE 303 Energy Conversion in Biological Systems	2
Hours Required for Graduation	130

BIOLOGICAL SCIENCES

Gardner Hall

Professor J. L. Apple, Assistant Director of Academic Affairs and Research for the Biological Sciences

Professor C. F. Lytle, Coordinator of Advising

The biological sciences curriculum is an interdepartmental program leading to a B.S. degree and designed for students desiring a comprehensive rather than a narrowly specialized education in the biological sciences. It is especially suitable for students preparing for graduate study in a specialized field of biology, for students planning to teach high school biology, and for students preparing for careers in business or industry.

Experience indicates one of the best preparations for graduate study in biology is a broad training in the basic biological sciences supplemented with a strong background in the physical and mathematical sciences. The biological sciences curriculum incorporates these features and provides the student with maximum flexibility and options for graduate specialization.

Students may concentrate on a specific field in the biological sciences curriculum by selecting appropriate free and restricted elective courses in consultation with their advisers. Such programs within the biological sciences curriculum are available to provide options in biochemistry, microbiology, and nutrition. Courses may be selected from the School of Education to provide a concentration in biology and teaching.

PROGRAMS IN THE BIOLOGICAL SCIENCES CURRICULUM

GENERAL

ALS 103 Introductory Topics in the Agricultural and Life Sciences	Credits 1	BO 421 Plant Physiology	4
<i>Languages (12 Credits)</i>		or	
ENG 111 Composition and Rhetoric	3	ZO 421 Vertebrate Physiology	3
ENG 112 Composition and Reading	3	or	
Foreign Language	6	BO (ZO) 414 Cell Biology	3
<i>Social Sciences and Humanities (21 Credits)</i>		<i>Physical Sciences and Mathematics (34-36 Credits)</i>	
Electives	21	MA 114 Intr. to Finite Mathematics with Applications	3
<i>Biological Sciences (31-33 Credits)</i>		or	
BS 100 General Biology	4	ST 311 Intro. to Statistics	
BO 200 Plant Life	4	or	
ZO 201 General Zoology	4	a 3-hour course in computer science and	
		MA 112, 212 Analytic Geometry and Calculus A and B	4+3
		or	

MA 102, 201, 202 Analytic Geometry & Calculus I, II and III	4+4+4	PY 211, 212 General Physics	4+4
CH 101 General Chemistry I	4	MB 401 General Microbiology	4
CH 107 Principles of Chemistry	4	BCH 351 Elementary Biochemistry	3
CH 221, 223 Organic Chemistry I and II	4+4	BO (ZO) 360 Introduction to Ecology	4
		GN 411 Principles of Genetics	3
		GN 412 Elementary Genetics Lab	1

NOTE: Students electing ZO 421 or BO (ZO) 414 must also elect either ZO 415 Cellular and Animal Physiology Laboratory 2
or
BCH 352 Experimental Biochemistry 2

*Electives (23-27 Credits)**

Restricted Electives from Groups A, B, C, and D	11-15
Free Electives	12
Sub Total	126
Physical Education	4
Hours Required for Graduation	130

BIOCHEMISTRY OPTION

For the requirements in the biological sciences curriculum, biochemistry emphasis, see BIOCHEMISTRY.

MICROBIOLOGY OPTION

Along with the general curriculum for the biological sciences, three additional microbiology electives are required; MB 411 and MR 501 are usually recommended. MB 401 is required in the BLS curriculum. For graduation, 130 semester credit hours are required.

NUTRITION OPTION

Four courses in nutrition are required along with the general curriculum for the biological sciences (FS 400, NTR 415, NTR 416, and NTR 490 are the usual requirements). For graduation, 130 semester credit hours are required.

* Group A includes the physical and biological sciences; Group B, economics and business management; Group C, applied science and technology; Group D, social sciences and humanities.

BOTANY

Gardner Hall

Professor Jerome P. Miksche, Head of Department

Professors: C. E. Anderson, R. J. Downs, J. W. Hardin, W. W. Heck (USDA), H. E. Pattee (USDA), H. Seltmann (USDA), E. D. Seneca, J. L. Thomas, J. R. Troyer; *Professors Emeriti:* D. B. Anderson, G. R. Noggle, H. T. Senfield, B. W. Wells, L. A. Whitford; *Associate Professors:* U. Blum, D. W. DeJong (USDA), R. C. Fites, R. L. Moit, A. M. Witherspoon; *Assistant Professors:* R. L. Beckmann, J. F. Reynolds, H. H. Rogers Jr. (USDA), J. M. Stucky, C. G. Van Dyke, T. R. Wentworth, T. E. Wynn; *Associate Members of the Faculty:* A. W. Cooper (Forestry), D. H. Timothy (Crop Science), D. E. Moreland (USDA Crop Science), S. C. Huber (USDA Crop Science), E. C. Sisler (Biochemistry), M. M. Goodman (Statistics), R. J. Thomas (Wood and Paper Science), B. J. Copeland (Zoology), R. J. Fellows (Crop Science)

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

OPPORTUNITIES

Many majors continue with graduate studies; see pages 17-18. There is need for such persons for teaching positions in community and junior colleges, colleges and universities, for

research positions in federal and state government laboratories and in private industry.

Recent federal and state legislation has created a need for botanists in environmental quality studies. Persons with a Bachelor of Science degree may work in air and water quality control programs, in air pollution and in environmental impact studies. Field botanists and naturalists are needed in park systems and nature programs.

UNDERGRADUATE CURRICULUM

The Bachelor of Science degree with a major in botany is offered under the science curriculum of the School of Agriculture and Life Sciences. The freshman year program is shown on page 67. Other basic requirements are on pages 67-71.

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

BOTANY

SCIENCE PROGRAM

	<i>Credits</i>		
ALS 103	1		
<i>Languages (12 Credits)</i>			
ENG 111	3		
ENG 112	3		
Literature Elective	3		
Language Elective	3		
<i>Social Sciences and Humanities (21 Credits)</i>			
Electives	21		
<i>Physical and Biological Sciences (29 Credits)</i>			
MA 111	4		
MA 112 or 114	4		
CH 101	4		
CH 103 or 107	4		
PY 221	5		
BS 100	4		
ZO 201	4		
		<i>Physical Education (4 Credits)</i>	
		Physical Education	4
		<i>Free Electives (20 Credits)</i>	
		Free Electives	20
		<i>Group A, B, C Courses (20 Credits)</i>	
		CH 220	4
		GN 411	3
		GN 412	1
		MB 401	4
		SSC 200	4
		Science Elective	4
		<i>Departmental Requirements and Electives (23 Credits)</i>	
		BO 200	4
		BO (ZO) 350	4
		BO 400	4
		BO 403	4
		BO 421	4
		BO 413	3
		Hours Required for Graduation	130

CONSERVATION

(Also see Forest Resources.)

Williams, Gardner and Biltmore Halls

M. G. Cook, *Major Adviser, School of Agriculture and Life Sciences*

L. C. Saylor, *Major Adviser, School of Forest Resources*

Conservation is the wise use, perpetuation, or improvement of natural resources, without waste, for the long-time benefit of society. This baccalaureate degree program is offered jointly by the Schools of Agriculture and Life Sciences and Forest Resources. Faculty members in botany, entomology, forestry, plant pathology, recreation, soil science and wildlife are directly involved in various aspects of education in conservation.

Rapid urbanization and industrialization concomitant with population growth and changes in lifestyles are bringing increased pressures on the use of land for providing food,

water, fiber, wood and pleasure. These trends present challenges to resource managers who must be well trained in the basic concepts of several disciplines in order to apply a conservation philosophy to many of our current natural resource problems.

CONSERVATION CURRICULUM

Students may enroll in either Agriculture and Life Sciences or Forest Resources, depending on their primary area of interest in conservation. The freshman common core of courses for either school is acceptable. All students take a prescribed core of subjects in conservation; specialty areas are developed through the use of electives. Students desiring an education with more professional emphasis may combine the conservation curriculum with another curriculum, e.g., forestry, soil science, zoology, to obtain a second degree.

SCIENCE PROGRAM

		Credits
ALS 103	Introductory Topics in the ALS	
	or	
FOR 101	Introduction to Forestry	1
<i>Languages (12 Credits)</i>		
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
	English Elective (Literature)	3
	English Elective	3
<i>Social Sciences and Humanities</i>		
<i>(21 Credits)</i>		
Electives		21
<i>Physical and Biological Sciences</i>		
MA 111	Algebra and Trigonometry	4
MA 112	Analytic Geometry and Calculus A	4
CH 101	General Chemistry I	4
CH 103	General Chemistry II	4
	or CH 107 Principles of Chemistry	4
PY 221	College Physics	5
BS 100	General Biology	4
	or	
BO 200	Plant Life	4
ZO 201	General Zoology	4
	or	
BO 200	Plant Life	4
<i>Physical Education</i>		
Physical Education		4
<i>Free Electives</i>		
Free Electives		13
<i>Group A, B, C Courses</i>		
ST 311	Introduction to Statistics	3
BO (ZO) 360	Introduction to Ecology	4
	Biological Science Electives	9
<i>Departmental Requirements and Electives</i>		
GY 120	Elements of Physical Geology	2
GY 110	Physical Geology Lab	1
ZO 221	Conservation of Natural Resources	3
SSC 200	Soil Science	4
FOR 472	Renewable Resource Management	3
RRA 241	Recreation Resource Relationships	3
ZO 353	Wildlife Management	3
	Conservation Electives	13
	Hours Required for Graduation	128

Elective courses may be used for emphasizing subject areas in communications, soils, wildlife biology, education and others.

CROP SCIENCE

Williams Hall

Professor B. E. Caldwell, *Head of the Department*

Professor D. A. Emery, *Coordinator of Advising*

TEACHING AND RESEARCH

Professors: C. A. Brim (USDA), J. C. Burns (USDA), D. S. Chamberlee, J. F. Chaplin (USDA), W. K. Collins, W. A. Cope (USDA), W. T. Fike, D. U. Gerstel, W. B. Gilbert, W. C. Gregory, H. D. Gross, G. L. Jones, K. R. Keller, J. A. Lee (USDA), W. M. Lewis, T. J. Mann, D. E. Moreland (USDA), C. F. Murphy, L. L. Phillips, J. C. Rice, D. L. Thompson (USDA), D. H. Timothy, J. B. Weber, E. A. Wernsman, J. A. Weybrew, A. D. Worsham; *Adjunct Professors:* J. S. Campbell, W. E. Wessling; *Professors Emeriti:* P. H. Harvey, R. L. Lovvorn, G. K. Middleton, R. P. Moore; *Associate Professors:* F. T. Corbin, G. R. Gwynn (USDA), R. C. Long, R. P. Patterson, W. W. Weeks; *Assistant Professors:* J. W. Burton (USDA), S. C. Huber (USDA), P. J. Beuscher, R. J. Fellows (USDA); *Institutes:* C. E. Collins, *Associate Members of the Faculty:* Heinz Seltmann (Botany), T. J. Sheets (Entomology and Horticultural Science).

EXTENSION

Professor G. L. Jones, In Charge, Crop Science Extension

Professors: C. T. Blake, S. N. Hawks, F. W. McLaughlin, A. Perry, Professor Emeriti: R. P. Bennett, S. H. Dobson, A. D. Stuart, Associate Professors: H. D. Cobble, E. L. Kirkbrugh, E. J. Dunphy, E. G. Krenzer, G. A. Sullivan, Associate Professor Emeriti: W. G. Thonney, Associate Professors: J. D. Mueller, Assistant Professor Emeriti: R. H. Crouse

The increase in human populations, the continuing evolution of pests and diseases, the challenge of new natural and artificial environments and the decrease of farmland are all critical current world issues.

This department's curricula were designed to give the crop science major an awareness and a sense of personal involvement in these issues. The student receives a working knowledge of the fundamental principles of plant science which tend to shape modern crop production practices. He or she is trained in the economics of various crop management procedures which may influence long-range investments.

OPPORTUNITIES

The opportunities within the state for crop science graduates in county extension programs, in farm management, as salesmen of seed and agricultural chemicals and in the several governmental agencies remain good. Demand for qualified students in national and international concerns is increasing.

For crop science graduate programs, see listing of graduate programs.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in crop science is offered under the science curriculum of the School of Agriculture and Life Sciences. The science curriculum follows.

Students may also earn a Bachelor of Science under the technology curriculum with a major in agronomy. The agronomy option is administered jointly by the Departments of Crop Science and Soil Science. For that curriculum see page 72.

The Departments of Crop Science, Entomology, Horticultural Science and Plant Pathology offer a joint undergraduate major in pest management for crop protection.

CURRICULUM IN CROP SCIENCE

SCIENCE PROGRAM

	<i>Credits</i>	
ALS 103 Introductory Topics in the ALS	1	
<i>Language(s), Credits</i>		
ENG 111 Composition and Rhetoric	3	
ENG 112 Composition and Reading	3	
Literature Elective	3	
Language Elective	3	
<i>Social Sciences and Humanities</i>		
<i>21 Credits</i>		
Electives	21	
<i>Physical and Biological Sciences</i>		
MA 111 Algebra and Trigonometry	4	
MA 112 Analytic Geometry and Calculus A	4	
CH 101 General Chemistry I	4	
CH 107 Principles of Chemistry	4	
PY 221 College Physics	5	
BS 100 General Biology	4	
BO 200 Plant Life	4	
<i>Physical Education</i>		
Physical Education	4	
<i>Free Electives</i>		
Free Electives	12	
<i>Group A, B, C Courses</i>		
<i>24 Credits</i>		
CH 221 Organic Chemistry I	4	
CH 223 Organic Chemistry II	4	
GN 411 The Principles of Genetics	3	
GN 412 Elementary Genetics Laboratory	1	
MA 114 Introduction to Finite Mathematics with Applications	4	
or		
MA 212 Analytic Geometry and Calculus B	3	
MB 401 General Microbiology	4	
PP 315 Plant Diseases	3	
PP 312 Diseases of Woody Orn. and Turf Grasses	1	
or		

PP 314 Diseases of Field Crops	1	CS 312 Pastures and Forage Crops	8
Electives in A, B, or C Courses	1	CS 414 Weed Science	4
<i>Departmental Requirements and Electives</i>			
<i>(27 Credits)</i>			
BO 421 Plant Physiology	4	CS 490 Senior Seminar in Crop Science	1
CS 211 Crop Science	4	ENT 312 Introduction to Economic Insects	3
CS 214 Crop Science Lab	1	SSC 200 Soil Science	4
		Soil Science Electives	3
		Hours Required for Graduation	130

DAIRY SCIENCE

(See Animal Science.)

ECONOMICS AND BUSINESS

Patterson Hall

Professor W. D. Toussaint, *Head of the Department*

Professor D. M. Hoover, *Assistant Head for Graduate Programs*

Professor B. M. Olsen, *Assistant Head and Coordinator for Advising*

Professor R. K. Perrin, *Coordinator of Advising for Agricultural Economics*

TEACHING AND RESEARCH

Professors G. A. Carlson, A. J. Couto, E. W. Erickson, R. M. Fearn, L. A. Ihnen, P. R. Johnson, Thomas Johnson, C. P. Jones, E. W. Jones, R. A. King, E. C. Passour Jr., R. J. Poelzer Jr., R. K. Perrin, R. A. Schrimper, J. A. Seagraves, R. L. Simmons, R. E. Sylla, C. B. Turner, J. C. Williamson Jr. *Visiting Professors* Douglas Fisher, *Professors Emeriti* A. J. Bartley, D. R. Dixon, J. G. Sutherland, USDA, E. W. Swanson, *Associate Professors* D. S. Ball, J. S. Chappell, L. E. Danelson, M. M. El Kammash, A. R. Gallant, H. C. Gilliam Jr. (USDA), T. J. Grunnes, C. W. Harrell Jr., D. M. Holthausen, D. N. Hyman, M. A. Johnson, J. S. Lapp, M. B. McElroy, F. A. Mangum Jr., C. J. Messere, J. C. Poindexter Jr., J. W. Wilson *Assistant Professors* S. G. Allen, R. L. Clark, D. B. Diamond, D. J. Fiath, J. D. Hanson, C. R. Knoeber, E. W. Leonard, M. P. Loeb, R. B. McBurney Jr., D. E. Morris (USDA), L. B. Perkins (USDA), W. P. Pinna, G. M. Scobie, D. A. Sumner, M. L. Walden, W. J. Wessels, M. K. Wohlgenant. *Assistant Professors Emeriti* J. C. Matthews Jr., O. G. Thompson *Instructors* W. P. Brown, Mary R. Hilliard, D. M. Holmes, T. M. Reynolds *Lecturers* A. M. Beals Jr., C. Lynn Bergold, C. E. Bowen, J. P. Huggard, Judith M. Jeffreys, Susan W. Johnson, W. P. Windham, *Associate Members of the Faculty* R. H. Bernhard (Industrial Engineering), D. L. Holley (Forestry)

EXTENSION

Professor R. C. Wells, *Assistant Head, In Charge of Extension*

Professors R. C. Brooks, R. D. Dahle, D. G. Harwood, H. L. Liner, T. E. Nichols Jr., E. A. Proctor, C. R. Pugh, W. L. Turner, C. R. Weathers; *Associate Professors* J. G. Allgood, J. E. Easley Jr., D. F. Neuman, D. D. Robinson, P. S. Stone, *Assistant Professors Emeriti* R. S. Boal, H. A. Homme; *Assistant Professors* G. A. Benson, J. S. Royer, G. F. Vocke, *Assistant Professor Emeritus* E. M. Stallings, *Extension Specialists* C. E. Hammond, S. C. Kiddick, S. R. Suttler

Agricultural economics, leading to a B.S. degree, is one of several fields of specialization offered by the Department of Economics and Business. The department is administered jointly by the Schools of Agriculture and Life Sciences and Humanities and Social Sciences. For information on fields of economics and business other than agricultural economics see Humanities and Social Sciences.

The department's general objectives in agricultural economics are: 1) To train students in the fundamentals of business organization and to make sound decisions in organizing and managing farms and other agricultural businesses; 2) To instruct students in economic theory which may be used as a basis for understanding the relationship of agriculture to other parts of the economy and for the evaluation of agricultural policy and economic changes which affect agriculture; 3) To train graduate students in advanced economic theory and research techniques. For a list of graduate degrees, see section listed on graduate degrees.

OPPORTUNITIES

The growing number of companies processing and manufacturing agricultural products has created an increasing demand for people trained in agricultural economics. Opportunities include employment by companies handling farm supplies, such as feed, fertilizer and equipment; general marketing and processing firms; agricultural cooperatives; professional farm management agencies, and various credit agencies.

Many graduates are employed in research and educational work by various agencies of the Federal and state governments. These include the Agricultural Extension Service, the Agricultural Experiment Station, the State Department of Agriculture and other agencies of the United States Department of Agriculture.

UNDERGRADUATE CURRICULA

The degree of Bachelor of Science with a major in economics and business may be obtained in either the science curriculum or the business curriculum. Students must meet all basic University requirements and Agriculture and Life Sciences requirements. The science program is for those desiring a strong background in the physical and biological sciences or preparation for graduate work. The business program is for students who have career interests in agriculturally-related businesses.

AGRICULTURAL ECONOMICS CURRICULUM

SCIENCE PROGRAM

ALS 103	Introductory Topics in the ALS	1	Bio Sc Elective	4
	<i>Loanships: 12 Credits</i>		PY 221 College Physics	5
ENG 111	Composition and Rhetoric	3	<i>Phy Ed & Free Electives</i>	
ENG 112	Composition and Reading	3	<i>116 Credits</i>	
	Electives English or Foreign Literature	6	Physical Education	4
	<i>Social Sciences and Humanities</i>		Free Electives	12
	<i>21 Credits</i>		<i>Group A, B or C Electives</i>	
EB 212	Econ. of Agriculture	3	<i>21-23 Credits</i>	
EB 202	Econ. II	3	ACC 260 Accounting I	3
	Electives	15	EB 350 Econ & Bus Statistics	3
	<i>Physical and Biological Sciences</i>		or	
	<i>41-42 Credits</i>		ST 311 Intro to Statistics	
MA 111	Algebra and Trig	4	Electives	16-17
or			<i>Major Requirements and Electives</i>	
MA 114	Intro to Finite Mathematics	3	<i>126 Credits</i>	
MA 112	Anal. Geom. & Calc A	4	EB 301 Production and Prices	3
MA 212	Anal. Geom. & Calc B	3	EB 302 Ag Econ. Analysis	3
CH 111	General Chem I	4	EB 303 or 523 or 551 Farm Production	
CH 103	General Chem. II	4	and Management Elective	3
BS 100 or 105	General Biology or Biology		EB 311 or 321 Agr. Mkt. Elective	3
	Modern World	4	EB 415 or 420 Finance Elective	3
			EB 533 Ag Policy	3
Restricted elec. 2 additional courses of following				
	EB 415, EB 430, EB 436 EB 515, EB 521, EB 523, EB 551	6		
Other Approved Electives in support of major*				
	Hours Required for Graduation	130		

* Approved electives are meant to include all EB and ACC courses plus others approved by the adviser.

BUSINESS PROGRAM

ALS 103	Introductory Topics in the ALS	1
<i>Languages (12 Credits)</i>		
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
ENG	Literature	3
SP 110	Public Speaking	3
<i>Social Sciences and Humanities (21 Credits)</i>		
EB 212	Econ. of Agriculture	3
EB 202	Econ. II	3
Electives		15
<i>Physical and Biological Sciences (24-25 Credits)</i>		
MA 111	Algebra & Trig or	4
MA 114	Intro. to Finite Math	3
MA 112 or 113	Analy. Geom. & Calc. A or Intro. to Calculus	4
CH 101	General Chemistry I	4
PY 221	College Physics	5
BS 100 or 105	General Biol. or Biol. in Modern World	4
BS	Science Elective	4
2 additional courses from group EB 415, EB 430, EB 436, EB 515, EB 521, EB 523, EB 551		
Approved Electives	in support of major*	8
Hours Required for Graduation		
		130

*Note: Approved electives are meant to include all EB and ACC courses plus others approved by the adviser.

<i>Phy. Ed. & Free Electives (16 Credits)</i>		
Physical Education	4	
Free Electives	12	
<i>Group B (24 Credits)</i>		
ACC 260	Accounting I	3
EB 303 or 523 or 551	Farm Production and Management Elective	3
EB 311 or 521	Agr. Mkt. Elective	3
EB 415 or 420	Finance Elective	3
EB 326 or 332 or 431	Labor and Per- sonnel Elective	2
EB 307	Business Law	3
Electives from Group B Courses		6
<i>Group A or C (3-6 Credits)</i>		
<i>Major Requirements and Electives (26 Credits)</i>		
EB 301	Production and Prices	3
EB 302	Ag. Ec. Analy.	3
EB 350	Econ. & Bus. Statistics	3
or		
ST 311	Intro. to Statistics	3
EB 533	Agr. Policy	3

ENTOMOLOGY

Gardner Hall

Professor Kenneth L. Knight, *Head of the Department*

Professor H. B. Moore Jr., *Coordinator of Advising*

TEACHING AND RESEARCH

Professors: R. C. Axtell, J. R. Bradley Jr., W. M. Brooks, W. V. Campbell, W. C. Dauterman, M. H. Farrier, F. E. Guthrie, Ernest Hodgson, W. J. Mistic Jr., H. B. Moore Jr., H. H. Neunzig, R. L. Rabb, G. C. Rock, T. J. Sheets, C. F. Smith, C. G. Wright, D. A. Young Jr.; *Adjunct Professors:* A. L. Chasson, J. R. Fouts; *Professor Emerita:* C. H. Brett, T. B. Mitchell; *Associate Professors:* P. P. Hain, R. E. Stinner, R. T. Yamamoto; *Adjunct Associate Professor:* Mary H. Ross; *Assistant Professors:* G. G. Kennedy, J. R. Meyer; *Adjunct Assistant Professors:* J. R. Bend, R. M. Philpot; *Associate Members of the Faculty:* D. S. Gusch (Genetics)

EXTENSION

Professor: G. T. Weekman, *Specialist-in-Charge*

Professor: R. L. Robertson; *Professor Emeritus:* G. D. Jones; *Associate Professor:* J. R. Baker, J. M. Falter, R. C. Hillmann, K. A. Sorensen, J. W. Van Duzen; *Assistant Professors:* J. T. Ambrose, C. S. Apperson, J. S. Bachelor

The entomology curriculum offers broad training at the undergraduate and graduate levels (see listing of graduate degrees) in basic biology and related sciences, particularly as they relate to the study of insects. In addition, several courses in entomology are offered at the undergraduate level for non-majors.

OPPORTUNITIES

Opportunities include development, production, control and sales positions in the pesticide field, consultative positions in pest management, regulatory and extension positions with state and federal agencies, and research technician positions in universities, agricultural experiment stations and industry. The curriculum also provides training suitable for admission to the graduate entomology departments of the country.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in entomology is offered under the science curriculum of the School of Agriculture and Life Sciences. Students are encouraged to gain through judicious use of their electives a strong background in the sciences. For the related undergraduate major in pest management for crop protection see section with that curriculum.

CURRICULUM IN ENTOMOLOGY

SCIENCE PROGRAM

	<i>Credits</i>		
ALIS 103 Introductory Topics in ALIS	1	Biol Sc Electives	8
<i>Language - 1 Credit</i>		<i>Physical Education</i>	
ENG 111 Composition and Rhetoric	3	Physical Education	4
ENG 112 Composition and Reading	3	Free Electives	12
Literary Elective	3	<i>Group A, B, C Courses</i>	
Language Elective	3	<i>22 Credits</i>	
<i>SCIENCE COURSES IN THE SCIENCES</i>		CH 220 Introductory Organic Chemistry	4
<i>121 Credits</i>		BCH 351 Elementary Biochemistry	3
Electives	21	GY 120 Elements of Physical Geology	2
<i>Physical and Biological Sciences</i>		or	
<i>32-33 Credits</i>		SSC 200 Soil Science	3
MA 111 Algebra and Trigonometry	4	ST 311 Introduction to Statistics	3
MA 112 Analytic Geometry and Calculus A	4	GN 111 The Principles of Genetics	3
		ZO 421 Vertebrate Physiology	3
MA 114 Introduction to Finite Mathematics with Applications	3	BO (ZO) 360 Introduction to Ecology	4
CH 101 General Chemistry I	4	<i>Departmental Requirements and Electives</i>	
CH 103 General Chemistry II	4	<i>26 Credits</i>	
or		ENT 312 Introduction to Economic Insects	3
CH 117 Principles of Chemistry	4	ENG 402 Insect Diversity	4
PY 221 College Physics	5	ENG 503 Functional Systems of Insects	4
BS 100 General Biology	4	Restricted Electives	15
		Hours required for Graduation	130

FOOD SCIENCE

Schaub Food Science Building

Professor W. M. Roberts, Head of the Department

Professor F. G. Warren, Coordinator of Advising

TEACHING AND RESEARCH

Professors L. W. Auerand, T. N. Blumer, H. B. Craig, H. P. Fleming (USDA), D. D. Hamann, M. W. Hoover, V. A. Jones, A. E. Purcell (USDA), M. L. Speck, H. E. Swaisgood, W. M. Walter Jr (USDA), *Professors Emeriti*, T. A. Bell, J. L. Etchells, I. D. Jones, *Associate Professors*, D. M. Adams Jr, H. R. Ball Jr, D. E. Carroll Jr, A. P. Hansen, R. F. McFeeters (USDA), C. T. Young, *Assistant Professors*, G. L. Catgnani Jr, T. R. Klaenhammer, T. C. Lanier, L. G. Turner, *Adjunct Associate Professors*, W. Y. Cobb, B. Ray

EXTENSION

Professor J. A. Christian, In Charge

Professors: E. Cofer, M. E. Gregory, N. C. Miller Jr., F. R. Tarver Jr., F. B. Thomas; Assistant Professors: R. E. Carawan, M. K. Hill, Specialist: S. D. Thomas

The Department of Food Science provides undergraduate and graduate programs for the application and coordination of the physical and biological sciences, economics 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 food microbiology and fermentation, food chemistry, food engineering and dairy, fruit, meat, poultry, seafood and vegetable products.

OPPORTUNITIES

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

Food industries career opportunities 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.

UNDERGRADUATE CURRICULA

The degree of Bachelor of Science with a major in food science is offered under the science or technology curriculum of the School of Agriculture and Life Sciences.

See listing of graduate degrees offered.

CURRICULA IN FOOD SCIENCE

SCIENCE PROGRAM

		<i>Credits</i>		
ALS 103	Introductory Topics in the ALS	3	<i>Prerequisite Electives, Credits</i>	
<i>Languages 112 Credits</i>			Electives	4
ENG 111	Composition and Rhetoric	3	<i>Free Electives 12 Credits</i>	
ENG 112	Composition and Reading	3	Electives	12
Literature	Elective	3	<i>Group A B C Course Electives</i>	
Language	Elective	3	CH 220	Introductory Organic Chemistry
<i>Small Sciences and Humanities 21 Credits</i>			CH 221	Organic Chemistry I
Electives		21	CH 223	Organic Chemistry II
<i>Physical and Biological Sciences 41 Credits</i>			CH 315	Quantitative Analysis
MA 111	Algebra and Trigonometry	4	MB 401	General Microbiology
MA 112	Analytic Geometry and Calculus A	4	Electives	11
MA 111	Introduction to Finite Mathematics with Applications	3	<i>Departmental Requirement and Electives 66 Credits</i>	
CH 101	General Chemistry I	4	FS 201	Food Science and Man's Food
CH 103	General Chemistry II or	4	FS 231	Food Engineering
CH 107	Principles of Chemistry	4	FS 402	Food Chemistry
BS 100	General Biology	1	FS 405	Food Microbiology
PV 211	General Physics	4	FS 490	Food Science Seminar
PV 212	General Physics	4	Electives	13
			<i>Hours Required for Graduation 130</i>	

TECHNOLOGY PROGRAM

		<i>Credits</i>		
ALS 103	Introductory Topics in the ALS	1	<i>Physical Education (4 Credits)</i>	
<i>Languages (12 Credits)</i>			Electives	4
ENG 111	Composition and Rhetoric	3	<i>Free Electives (12 Credits)</i>	
ENG 112	Composition and Reading	3	Electives	12
SP 110	Public Speaking	3	<i>Group A, B, C Courses (25 Credits)</i>	
Literature Elective		3	CH 229	Introductory Organic Chemistry or
<i>Social Sciences and Humanities</i>			CH 221	Organic Chemistry I
<i>21 Credits</i>			CH 223	Organic Chemistry II or
Electives		21	CH 315	Quantitative Analysis
<i>Physical and Biological Sciences</i>			MB 401	General Microbiology
<i>18 Credits</i>			Electives	13
MA 111	Algebra and Trigonometry	4	<i>Departmental Requirements and Electives</i>	
MA 112	Analytic Geometry and Calculus A	4	<i>(27 Credits)</i>	
MA 114	Introduction to Finite Mathematics with Applications	3	FS 201	Food Science and Man's Food
CH 101	General Chemistry, I	4	FS 331	Food Engineering
CH 103	General Chemistry, II or	4	FS 402	Food Chemistry
CH 107	Principles of Chemistry	4	FS 405	Food Microbiology
BS 100	General Biology	4	FS 490	Food Science Seminar
PY 221	College Physics	3	Electives	14
			Hours Required for Graduation 130	

GENETICS

Gardner Hall

Professor J. G. Scandalios, Head of the Department

Professors: L. G. Burk (USDA), D. S. Grosch, W. D. Hanson, W. E. Kloos, C. S. Levings III, T. J. Mann, D. F. Matzinger, R. H. Moil, Gene Namkong, USFS, H. E. Schaffer, C. W. Stuler (USDA), A. C. Triantaphyllou; *Professors Emeriti:* C. H. Bristan, L. E. Mutter, E. W. Smith, S. G. Stephens; *Adjunct Professor:* H. V. Malinge; *Associate Professors:* W. H. McKenzie, R. R. Sederuff; *Assistant Professors:* G. C. Besley, S. M. Flashman, C. C. Laurie Ahlberg, J. C. Sorenson; *Associate Members of the Faculty:* E. U. Dillard, E. J. Eisen, J. E. Legates, B. T. McDaniel, O. W. Robison (Animal Science), F. B. Armstrong (Biochemistry and Microbiology), C. A. Brim (USDA), J. F. Chaplin (USDA), W. A. Cope (USDA), D. A. Emery, D. U. Gerstel, W. C. Gregory, G. R. Gwynn (USDA), J. A. Lee (USDA), C. F. Murphy, L. L. Phillips, D. L. Thompson (USDA), D. H. Timothy, E. A. Wernsman (Crop Science), C. C. Cockerham, M. M. Goodman, J. O. Rawlings (Statistics), T. O. Perry, L. C. Saylor, B. J. Zobel (Forestry), F. L. Haynes Jr. (Horticultural Science), J. L. Apple, T. T. Hebert, N. T. Powell (Plant Pathology), E. W. Glazener, G. A. Martin (Poultry Science).

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. The graduate program is designed to train scientists for research and teaching careers in basic genetics and in its application in plant and animal breeding.

See listing of graduate degrees offered.

CURRICULUM

Since there is no genetics baccalaureate program, undergraduates are encouraged to pursue a biological sciences program.

HORTICULTURAL SCIENCE

Kilgore Hall

Professor A. A. De Hertogh, Head of the Department

Professor W. E. Ballinger, Coordinator of Advising

TEACHING AND RESEARCH

Professors: F. L. Haynes Jr., T. R. Konsler, R. A. Larson, R. L. Lower, C. H. Miller, T. J. Monaco, W. B. Nesbitt, P. V. Nelson, A. C. Triantaphyllou; *Associate Professor:* R. L. Swycer; *Professors Emeriti:* F. D. Cochran, J. M. Jenkins, D. T. Pope, G. O. Randall; *Associate*

Professors: L. K. Hammett, W. R. Henderson, D. M. Pharr, J. C. Raulston, R. M. Southall, C. R. Unrath, D. C. Zeiger; Assistant Professors: J. R. Ballington, T. E. Bilderback, F. A. Blazich, W. C. Fonteno, R. G. Gardner, J. E. Green, Research Assistant Professors: V. P. Bonaminio, W. W. Collins, L. E. Hinesley, R. D. Lacy, M. E. Saltveit; Associate Members of the Faculty: R. J. Downs (Botany), R. L. Mott (Botany), T. J. Sheets (Entomology, Crop Science), R. H. Moll (Genetics), R. Aycock (Plant Pathology), R. J. Volk (Soils)

EXTENSION

Professor A. A. Banadyga, *In Charge*

Professors: M. H. Kolbe, J. W. Love, C. M. Mainland, W. A. Skroch, Professors Emeriti: H. M. Covington, J. H. Harris; Associate Professors: G. R. Hughes, W. W. Reid, D. C. Sanders, L. G. Wilson, J. H. Wilson Jr.; Assistant Professor: M. A. Powell

Undergraduate programs in horticultural science offer broad training in physical and biological sciences and a sound cultural background. Students can concentrate studies in the areas of fruit and vegetable crops, floriculture, nursery management, or landscape horticulture. They are prepared for either graduate study or for diverse professional service. (See listing of graduate degrees offered.)

North Carolina's varied climatic conditions make possible the production of a wide variety of horticultural crops on a commercial scale, as well as in parks and gardens. These crops now represent an important segment of N. C. agriculture with further expansion to be realized with the development of adapted varieties, mechanization and intensification of cultural practices, improvement of handling and marketing methods and the development of the food processing industry.

OPPORTUNITIES

Horticulture graduates fill positions in production, processing, sales and service. Among these are county extension agents; vocational agricultural teachers; landscaping and landscape contracting; 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.

UNDERGRADUATE CURRICULA

The degree of Bachelor of Science with a major in horticultural science can be earned in either science or technology offered by the School of Agriculture and Life Sciences. Under these curricula, specialized training is offered in fruit and vegetable crops, and in floriculture, ornamental horticulture (nursery management), and landscape horticulture. (There is also a joint undergraduate major in pest management for crop protection.) See the freshman year and basic requirements, School of Agriculture and Life Sciences.

CURRICULA IN HORTICULTURAL SCIENCE

TECHNOLOGY PROGRAM

		<i>Credits</i>		
ALS 103	Introductory Topics in the ALS ...	1	<i>Prerequisites of Biological Sciences</i>	
<i>Languages 12 Credits</i>			MA 131	Algebra and Trigonometry ...
ENG 111	Composition and Rhetoric ...	3	MA 132	Analytic Geometry and
ENG 112	Composition and Reading ...	3		Calculus A ...
SP 110	Public Speaking ...	3	MA 111	Intro to Finite Mathematics
Literature Elective	...	3		with Applications
<i>Social Sciences and Humanities</i>			CH 101	General Chemistry I ...
<i>21 Credits</i>				General Chemistry II ...
Electives	...	21	PH 221	College Physics ...
			BS 100	General Biology ...
			BO 299	Plant Life ...
			SSC 210	Soil Science ...

<i>Physical Education</i>	
Physical Education	4
<i>Free Electives</i>	
Free Electives	12
<i>Group A, B, C Courses (20 Credits)</i>	
HS 201 Principles of Horticulture (LH)	3
ENT 412 Introduction to Economic Insects	3
PP 315 Plant Diseases	3
SSC 341 Soil Fertility and Fertilizers (FV,OH,F)	3
BO 121 Plant Physiology	3
HS 301 Plant Propagation (FV,OH,F)	3
GN 412 Elementary Genetics Lab (FV,OH,F)	1
<i>Departmental Requirements and Electives (27-28 Credits)</i>	
Students will choose one of the following: PP 310, PP 311, PP 312, or PP 313	
HS 391 Senior Seminar in Horticultural Science	1

FV Fruits and Vegetables, OH Ornamental, F Floriculture, LH Landscape

SCIENCE PROGRAM

	<i>Credits</i>
ALS 104 Introductory Topics in the ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
Literature Elective	3
Language Elective	3
<i>Social Sciences and Humanities (21 Credits)</i>	
Electives	21
<i>Physical and Biological Sciences</i>	
MA 111 Algebra and Trigonometry	4
MA 112 Analytic Geometry and Calculus A or	4
MA 114 Intro. to Finite Math. with Applications	3
CH 101 General Chemistry I	4
CH 103 General Chemistry II	4
PY 221 College Physics or	5
PY 211, 212 General Physics	8
BS 100 General Biology	4
BO 200 Plant Life	4
<i>Physical Education</i>	
Physical Education	4
<i>Free Electives</i>	
Free Electives	12

FV Fruits and Vegetables, OH Ornamental, F Floriculture

GN 411 The Principles of Genetics (FV,OH,F)	3
Technical Elective (FV,OH,F)	2
Departmental Elective (FV 14) (OH-8) (F 11)	Variable
HS 421 Tree Fruit Production (FV)	3
HS 432 Vegetable Production (FV)	3
HS 562 Post Harvest Physiology (FV)	3
HS 211 Ornamental Plants (OH,F,LH)	3
HS 212 Ornamental Plants (OH,F,LH)	3
HS 411 Nursery Management (OH,LH)	3
HS 414 Residential Landscape (OH,LH)	4
HS 471 Arboriculture (OH,LH)	3
HS 441 Floriculture I (F)	3
HS 442 Floriculture II (F)	3
HS 342 Landscape Horticulture (LH)	3
HS 495 Special Topics in Horticultural Science	2
HS 352 Landscape Design Presentation (LH)	2
DN 232 Intro. to Nat. Systems & the Built Environ (LH)	3
DN 430 Site Planning (LH)	3
DN 257, 258 or 431, 424 (LH)	6
Hours Required for Graduation	130

Group A, B, C Courses (20-23 Credits)

CH 220 Organic Chemistry	4
MB 401 Microbiology	4
BO 421 Plant Physiology	4
ENT 312 Introduction to Economic Insects	3
PP 315 Plant Diseases	3
SSC 300 Soil Science	4
Group A Electives	3
<i>Departmental Requirements and Electives (26 Credits)</i>	
Students will choose one of the following: PP 310, PP 311, PP 312, or PP 313	
HS 201 Principles of Horticulture	3
GN 411 The Principles of Genetics	3
GN 412 Genetics Lab	1
HS 491 Senior Seminar in Horticultural Science	1
HS 411 Nursery Management (OH)	3
HS 471 Arboriculture (OH)	3
HS 211 Ornamental Plants (OH,F)	3
HS 212 Ornamental Plants (OH,F)	3
HS 301 Plant Propagation (OH,F)	3
SSC 341 Soil Fertility and Fertilizers (OH,F)	3
HS 441 Floriculture I (F)	3
HS 442 Floriculture II (F)	3
HS 421 Tree Fruit Production (FV)	3
HS 432 Vegetable Production (FV)	3
HS 562 Post Harvest Physiology (FV)	3
Horticultural Science Electives (FV)	9
Hours Required for Graduation	130

INDIVIDUALIZED STUDY PROGRAM

Professor E. W. Glazener, Coordinator of Advising

The individualized study program entails a curriculum planned by the student with the assistance of a faculty advisory committee. Interested students are requested to follow details of the program through the Director of Academic Affairs, 115 Patterson Hall.

MEDICAL TECHNOLOGY

Gardner Hall

G. C. Miller, Coordinator of Advising

North Carolina State University has two parallel programs in medical technology. One is a four year curriculum with a Bachelor of Science in zoology followed by a year of training in a hospital laboratory school.

The second program is designed to be completed in four calendar years. The student takes a prescribed curriculum for three years at North Carolina State University. The fourth year consists of a 12-month course in medical technology at an affiliated clinical program. Upon completion, a Bachelor of Science degree will be granted from N. C. State and a certificate in medical technology from the affiliated hospital. (See zoology.)

MICROBIOLOGY

Gardner Hall

Professor J. B. Evans, Head of the Department

Professors: W. J. Dobrogosz, G. H. Elkan, J. J. Perre, Ad. Inst. Associate Prof. & R. E. Kanich, A. Inst. & Prof. P. E. Bishop, USDA; R. E. Johnston, G. H. Lugnbuhl, T. Melton, Ad. Inst. & Asst. Prof. D. H. King, Associate Members of the Faculty: J. G. Lecce, J. J. McNeill (Animal Science), F. B. Armstrong (Biochemistry), M. L. Speck, F. of Science, W. E. Klous (Genetics), P. B. Hamilton (Poultry Science), A. G. Wollum II (Soil Science), D. G. Summers (Veterinary Science)

The microbiology program provides basic preparation for professional microbiologists, a microbiology background for 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 tiny, generally single-celled, organisms. These organisms may 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 environmental quality, production of food and fuel, and human health, will rely heavily on understanding microbial processes.

OPPORTUNITIES

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

CURRICULUM

There is no microbiology undergraduate major, so students with a primary interest in microbiology are advised to take the biological sciences curriculum with the microbiology option (See curriculum under biological sciences.) This requires 3 courses (9 credits) in microbiology in addition to MB 401, which is part of the basic biological sciences requirements. However, if a student does not plan to go beyond the Bachelor of Science level, and

desires to qualify for registration or a civil service position as a microbiologist, 20 credits in microbiology should be taken.

See listing of graduate degree programs.

PEST MANAGEMENT FOR CROP PROTECTION

Gardner, Kilgore and Williams Halls

Blanche C. Haning, *Coordinator of Advising*

The major in pest management for crop protection is an interdepartmental program involving crop science, entomology, horticultural science and plant pathology.

Students in pest management for crop protection receive training in the concepts of controlling crop pests in an ecologically sound manner. Crop losses from diseases, insects, nematodes and weeds annually run into the billions of dollars in the United States. Environmental concerns dictate that control efforts against these organisms must be integrated into a total crop production management program on a systems approach basis. A high degree of flexibility in electives permits the student either to become generally proficient across the field or to develop an area of strength against a particular class of pest organisms.

OPPORTUNITIES

Opportunities basically involve improving farm efficiency to meet our ever-growing need for food and fiber. Current federal and state statutes require a high degree of expertise in the accomplishment of pest control. Completion of the training provided by this curriculum qualifies the graduate for positions as county extension agents, as federal and state regulatory agents, as technicians in scientific research organizations, as pest control specialists in agribusiness concerns, and as custom pest management operators.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in pest management for crop protection is offered under the agricultural science curriculum of the School of Agriculture and Life Sciences.

See the freshman year and basic requirements School of Agriculture and Life Sciences.

CURRICULUM IN PEST MANAGEMENT FOR CROP PROTECTION

SCIENCE PROGRAM

		<i>Credits</i>			
ALS 103	Introductory Topics in the ALS	1	MA 114	Introduction to Finite Mathematics with Applications	3
<i>Language (12 Credits)</i>			CH 101	General Chemistry I	4
ENG 111	Composition and Rhetoric	3	CH 103	General Chemistry II	4
ENG 112	Composition and Reading	3	<i>or</i>		
Literature Elective	3		CH 107	Principles of Chemistry	4
Language Elective	3		PY 221	College Physics	5
<i>Social Sciences and Humanities (21 Credits)</i>			BS 100	General Biology	4
Electives	21		<i>Physical Education</i>		
<i>Physical and Biological Sciences (24-25 Credits)</i>			Physical Education	4	
MA 111	Algebra and Trigonometry	4	<i>Free Electives</i>		
MA 112	Analytic Geometry and Calculus A	4	Free Electives	12	
<i>or</i>			<i>Group A, B, C Courses (18 Credits)</i>		
			CH 220	Introductory Organic Chemistry	4

BCH 351	Elementary Biochemistry	3
BO (ZO) 360	Introduction to Ecology	4
SSC 200	Soil Science	4
BO 421	Plant Physiology	4
<i>Major Requirements and Electives (36 Credits)</i>		
ENT 312	Introduction to Economic Insects	3
ENT 550	Fundamentals of Insect Control	3
PP 315	Plant Diseases	3
PM 111	Intro to Integrated Pest Management	1

Students must choose one of the following:		
PP 310, 311, 312, 313, 314		1
PM 490	Pest Management Seminar	1
PP 500	Plant Disease Control	3
CS 414	Weed Science	4
CS (HS) 514	Principles and Methods in Weed Science	3
CS 211	Crop Science	4
PM 415	Principles of Pest Management	4
Restricted Electives		6
Hours Required for Graduation		130

PLANT PATHOLOGY

Gardner Hall

Professor R. Aycock, Head of the Department

TEACHING AND RESEARCH

Professors J. L. Apple, K. R. Barker, M. K. Beute, C. N. Clayton, E. Echandi, G. V. Gooding Jr., L. F. Grand, T. T. Hebert, S. F. Jenkins Jr., K. J. Leonard (USDA), G. B. Lucas, C. E. Main, R. D. Milholland, N. T. Powell, R. A. Reinert (USDA), J. P. Ross (USDA), J. N. Sasser, H. W. Spurr Jr. (USDA), D. L. Strider, H. H. Triantaphyllou, R. E. Welts (USDA), N. N. Winstead; *Professors Emeriti* D. E. Ellis, L. W. Nielsen, C. J. Nushbaum, F. L. Wellman; *Adjunct Professors* G. H. Hepting, E. G. Kuhlman; *Associate Professors* A. S. Heagle (USDA), L. T. Lucas; *Adjunct Associate Professors* N. A. Lapp (NCDA), *Assistant Professors* D. M. Benson, B. C. Haining, Jeng sheng Huang, J. W. Meyer, G. A. Payne, D. F. Ritchie, T. B. Sutton, C. G. Van Dyke; *Adjunct Assistant Professor* D. A. Rickard (NCDA); *Visiting Assistant Professors* S. I. Cohen, J. L. Starr; *Associate Members of the Faculty* E. B. Cowling (Forestry), C. B. Davey (Forestry), M. P. Levy (Forestry)

EXTENSION

Professor H. E. Duncan, In Charge

Professors C. W. Averett III, F. A. Todd, J. C. Wells; *Associate Professors* R. K. Jones, P. B. Shoemaker, D. P. Schmitt, J. H. Wilson Jr.

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, pest management, agricultural education and forestry. It also provides fundamental training necessary for graduate study in plant pathology.

The Department of Plant Pathology cooperates in training pest management for crop protection majors, but does not offer an undergraduate major in plant pathology. See listing of graduate degrees offered.

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 and in industry. The rapid development of agricultural chemicals and other methods for disease control offers numerous opportunities. See pest management for crop protection.

POULTRY SCIENCE

Scott Hall

Professor R. E. Cook, Head of the Department

Professor C. R. Parkhurst, Coordinator of Advising

TEACHING AND RESEARCH

Professors W. E. Donaldson, E. W. Glazener, P. B. Hamilton, C. H. Hill, C. R. Parkhurst, J. P. Thaxton; *Adjunct Professors* R. L. Baron, K. N. May; *Professors Emerita*, C. W. Barber; *Associate Professors* J. D. Garlich; *Adjunct Associate Professors* N. Cloutier, *Assistant Professors Emeriti* W. L. Blum, F. W. Cook; *Assistant Professor* V. L. Christensen, F. W. Elyen, G. W. Morgan Jr., J. Shih; *Lecturers* C. M. Williams; *Associate Member of the Faculty* D. G. Simmons; *Veterinary Science*

EXTENSION

Professor W. C. Mills Jr., *In Charge*

Professors W. G. Anderson, J. R. Harris, G. A. Martin, J. B. Ward; *Professor Emerita*, T. B. Morris; *Associate Professor* T. A. Carline; *Assistant Professor*, F. T. Jones, J. R. West; *Extension Specialist*, C. E. Brewer

The Department of Poultry Science provides instruction in the principles of poultry husbandry and in such related fields as nutrition, physiology and genetics.

Through teaching, research and extension, the department serves students, poultrymen and allied industries. Poultry production has increased rapidly during the last two decades and ranks second in North Carolina as a source of agricultural income. North Carolina ranks fourth 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. Off-the-farm operations in activities such as processing and distribution offer new job opportunities. The allied industries—feed, equipment, financing and drugs—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.

UNDERGRADUATE CURRICULUM

Students desiring the Bachelor of Science with a major in poultry science may choose either the science or technology curriculum offered by Agriculture and Life Sciences. 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 advisors 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 School 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.

TECHNOLOGY PROGRAM

This is a more generalized program of study as the curriculum offers a greater selection of courses in the applied science and technology areas.

CURRICULA IN POULTRY SCIENCE SCIENCE PROGRAM

		<i>Credits</i>
ALS 108	Introductory Topics in the ALS	1
	<i>Languages (12 Credits)</i>	
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
	Literature Elective	3
	Language Elective	3
	<i>Social Sciences and Humanities (21 Credits)</i>	
Electives		21
	<i>Physical and Biological Sciences (28 Credits)</i>	
MA 111	Algebra and Trigonometry	4
MA 112	Analytic Geometry and Calculus A	4
	or	
MA 114	Introduction to Finite Mathe- matics with Applications	3
	or	
MA 102	Analytic Geometry and Calculus I	4
CH 101	General Chemistry I	4
CH 107	Principles of Chemistry	4
PY 211	General Physics	4
	or	
PY 221	College Physics	5
BS 100	General Biology	4
MB 401	General Microbiology	4

TECHNOLOGY PROGRAM

		<i>Credits</i>
ALS 108	Introductory Topics in the ALS	1
	<i>Languages (12 Credits)</i>	
ENG 111	Composition and Rhetoric	3
ENG 112	Composition and Reading	3
SP 110	Public Speaking	3
	Literature Elective	3
	<i>Social Sciences and Humanities (21 Credits)</i>	
Electives		21
	<i>Physical and Biological Sciences (31 to 33 Credits)</i>	
MA 111	Algebra and Trigonometry	4
MA 112	Analytical Geometry and Calculus A	4
	or	
MA 114	Introduction to Finite Mathe- matics with Applications	3
	or	
MA 102	Analytical Geometry and Calculus I	4
CH 101	General Chemistry I	4
CH 108	General Chemistry II	4
	or	
CH 107	Principles of Chemistry	4
PY 221	College Physics	5
	or	
PY 211	General Physics	4
BS 100	General Biology	4

	<i>Physical Education (4 Credits)</i>	
PE Electives		4
	<i>Free Electives (12 Credits)</i>	
Free Electives		12
	<i>Group A, B, C Courses (26 Credits)</i>	
PY 212	General Physics (If PY 211 was taken)	4
GN 411	Principles of Genetics	3
CH 221	Organic Chemistry I	4
	Elective in Group A (Biological Science)	4
	Electives in A, B or C Courses	11
	<i>Departmental Requirements and Electives (26 Credits)</i>	
PO 201	Poultry Science and Production	4
PO 401	Poultry Diseases	4
PO 404	Poultry Products	3
PO 405	Avian Physiology	4
PO 415	Comparative Nutrition	3
PO 490	Poultry Seminar	1
PO 520	Poultry Breeding	3
PO 524	Comparative Endocrinology	4
	Select a minimum of two courses from:	4
	PO 420 Turkey Production (2)	
	PO 421 Commercial Egg Production (2)	
	PO 422 Incubation and Hatchery Mgmt. (2)	
	PO 423 Broiler Production (2)	
	Hours Required for Graduation	130

MB 401	General Microbiology	4
	Elective in Group A (Biological Science)	4
	<i>Physical Education (4 Credits)</i>	
PE Electives		4
	<i>Free Electives (12 Credits)</i>	
Free Electives		12
	<i>Group A, B, C Courses (19 to 22 Credits)</i>	
GN 411	The Principles of Genetics	3
CH 220	Introductory Organic Chemistry	4
	or	
CH 221	Organic Chemistry I	4
PY 212	General Physics (If PY 211 was taken)	4
	Electives in A, B, or C Courses	11 to 15
	<i>Poultry Science Requirements and Electives (28 Credits)</i>	
PO 201	Poultry Science and Production	4
PO 301	Evaluation of Live Poultry	2
PO 401	Poultry Diseases	4
	Select a minimum of two courses from:	4
	PO 420 Turkey Production (2)	
	PO 421 Commercial Egg Production (2)	
	PO 422 Incubation and Hatchery Management (2)	

PO 423 Broiler Production (2)		PO 490 Poultry Seminar	1
PO 401 Poultry Products	3	PO 520 Poultry Breeding	3
PO 405 Avian Physiology	4	Hours Required for Graduation	130
PO 115 Comparative Nutrition	3		

PREMEDICAL SCIENCES

Gardner Hall and Grinnells Laboratory

J. R. Roberts and W. C. Grant, *Coordinators of Advising*

Premedical, premedical and preveterinary programs are offered as a group of core courses in several curricula tracts in the School of Agriculture and Life Sciences. Requirements for all the premedical sciences are similar. Requirements may be met either through the science curriculum or the biological sciences curriculum. A number of students are accepted each year in leading medical colleges; several have received outstanding scholarships.

For further details on the preveterinary curriculum, see veterinary science.

For the premedical and premedical details, see zoology and the biological sciences curriculum.

SOCIOLOGY AND ANTHROPOLOGY

(Also see Humanities and Social Sciences)

1911 Building

Professor S. C. Mayo, Head of the Department

Associate Professor E. M. Suval, Assistant Head of the Department

Professor J. N. Young, Coordinator of Advising

Associate Professor A. C. Davis, Coordinator of Advising (Rural Sociology)

TEACHING AND RESEARCH

Professors W. B. Clifton, H. L. W. Drabick, C. P. Marsh, G. C. McCann, R. D. Mustian, M. M. Sawhney, J. N. Young.
Professors Emeriti H. D. Rawls, *Associate Professor* E. Winston, *Assistant Professors* R. C. Brinson, A. C. Davis, C. V. Meyer, R. L. Mackles, G. S. Niekamp, J. G. Puck, I. E. Russell, D. Lyzell, M. L. Walek, R. C. Wimberty, *Assistant Professors* W. T. Austin, C. G. Danson, L. R. Della Fave, V. A. Hidas, T. M. Hymen, J. C. Leiter, P. T. McFarlane, W. C. Peubels, I. Rovner, M. D. Schulman, R. J. Thomson, K. M. Troost, J. M. Wallace, E. M. Woodrum, M. T. Zingraff,
Instructors R. S. Elvich, L. L. SWE, E. B. Mackie, D. H. Shuman

EXTENSION

Professor J. N. Collins, In Charge of Community Development

Professors J. D. George, T. N. Holgrod Jr., C. E. Lewis, M. E. Voland, *Professor Emeritus* J. W. Crawford, *Associate Professors* V. E. Hampton, P. P. Thompson, *Assistant Professor* J. E. Burton, T. T. McKinney, *Extension Specialist* G.W. H. H. Goetsch

This department teaches students the principles and techniques for understanding human group behavior. More specifically the department seeks: (1) to train students to become leaders in organizing groups and communities and in administering their programs; (2) to qualify exceptional students on the undergraduate and graduate levels for sociological research, teaching and extension work; (3) to solve problems in human group relations through scientific research; and (4) to extend research results to the people of the State.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in rural sociology is offered under the science curriculum of the School of Agriculture and Life Sciences. Majors in this department are offered an option in criminal justice.

See listing of graduate degrees.

CURRICULUM IN RURAL SOCIOLOGY

SCIENCE PROGRAM

	Credits
ALS 103 Introductory Topics in the ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
Literature Elective	3
Language Elective	3
<i>Social Sciences and Humanities (21 Credits)</i>	
SOC 202 Principles of Sociology	3
Electives	18
<i>Physical and Biological Sciences (29 Credits)</i>	
MA 111 Algebra and Trigonometry	4
MA 112 Analytic Geometry and Calculus A	4
CH 101 General Chemistry I	4
CH 103 General Chemistry II	4
or	
CH 107 Principles of Chemistry	4
PY 221 College Physics	5
BS 100 General Biology	4
Botany or Zoology Elective	4

<i>Physical Education (4 Credits)</i>	
Physical Education	4
<i>Free Electives (12 Credits)</i>	
Free Electives	12
<i>Group A B. C. D Courses</i>	
GN 411 The Principles of Genetics	3
or	
GN 301 Genetics in Human Affairs	2
GY 120 Elements of Physical Geology	1
GY 110 Physical Geology Laboratory	3
ST 311 Introduction to Statistics	3
Electives in A, B, C, or D Courses	15
<i>Departmental Requirements and Electives</i>	
SOC 241 Rural Society, USA	3
SOC 301 Human Behavior	3
SOC 342 Rural Societies Around the World	3
SOC 416 Research Methods	3
SOC 311 Community Relationships	3
ANT 252 Cultural Anthropology	3
Sociology and Anthropology Electives	9
Hours Required for Graduation	130

SOIL SCIENCE

Williams Hall

Professor C. B. McCants, Head of the Department

Professor M. G. Cook, Coordinator of Advising

Professors: S. W. Baol, F. R. Cox, G. A. Cummings, J. W. Gilliam, W. A. Jackson, E. J. Kamprath, R. J. Volk, S. B. Weed, A. G. Wollum; *Professors Emeriti:* W. V. Bartholomew, J. W. Fitts, J. F. Lutz, W. G. Woltz, W. W. Woodhouse Jr.; *Associate Professors:* G. R. Burns (USDA), B. L. Carlile, D. K. Cassel, R. E. McCollum, C. D. Raper, P. A. Sanchez, J. E. Shelton; *Associate Professors Emeriti:* W. D. Lee, A. Mehlich, J. R. Piland, W. H. Rankin; *Assistant Professors:* R. M. Cruse, D. W. Israel (USDA), L. D. King, H. J. Kleias, C. K. Martin, G. S. Mier, G. C. Naderman, J. J. Nicholaides, W. F. Robarge, R. L. Uebler; *Adjunct Assistant Professor:* D. W. Eaddy; *Visiting Assistant Professors:* D. E. Bandy, G. F. Feedin, J. F. Thomas; *Associate Members of the Faculty:* E. D. Seneca (Botany), R. W. Skaggs (Bio and Ag Engineering), J. B. Weber (Crop Science), C. B. Davey (Forestry); *Assistant Professor Emerita:* L. E. Aull

EXTENSION

Professors: J. V. Baird, J. A. Phillips; *Assistant Professor:* G. C. Naderman

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 useful in conserving environmental quality. Therefore, the demand for people trained in soils by 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 agricultural, conservation and resource planning work. 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, and as technical representatives and salesmen in fertilizer companies and other agribusiness.

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. Also, there are increasing opportunities in support of agribusiness.

UNDERGRADUATE CURRICULUM

The Bachelor of Science degree may be obtained in the Department of Soil Science under any of three curricula—science, technology, or conservation. See basic requirements and freshman year for School of Agriculture and Life Sciences. See the conservation curriculum and the agronomy curriculum.

CURRICULUM IN SOIL SCIENCE

SCIENCE PROGRAM

	<i>Credits</i>		
ALS 103	Introductory Topics in the ALS	1	
<i>Languages (12 Credits)</i>			
ENG 111	Composition and Rhetoric	3	
ENG 112	Composition and Reading	3	
	Literature Elective	3	
	Language Elective	3	
<i>Social Sciences and Humanities (21 Credits)</i>			
Electives		21	
<i>Physical and Biological Sciences (81 Credits)</i>			
MA 111	Algebra and Trigonometry	4	
MA 114	Introduction to Finite Mathematics with Applications	3	
CH 101	General Chemistry I	4	
CH 103	General Chemistry II or		
CH 107	Principles of Chemistry	4	
PY 211	General Physics	4	
PY 212	General Physics	4	
BS 100	General Biology	4	
BO 200	Plant Life	4	
<i>Physical Education</i>			
Physical Education		4	
<i>Free Electives</i>			
Free Electives			12
<i>Group A, B, C Courses (22 Credits)</i>			
MA 112	Analytical Geometry and Calculus A	4	
MA 212	Analytical Geometry and Calculus B	3	
	Chemistry Elective	4	
	Chemistry Elective	4	
BO 421	Plant Physiology	4	
GY 110	Physical Geology Lab	1	
GY 120	Elements of Physical Geology	2	
<i>Departmental Requirements and Electives (27 Credits)</i>			
SSC 200	Soil Science	4	
SSC 341	Soil Fertility and Fertilizers	3	
SSC 342	Soil Fertility Laboratory	1	
SSC 352	Soil Classification	4	
SSC 461	Soil Physical Properties and Plant Growth	3	
SSC (CS) 462	Soil-Crop Management Systems	3	
SSC 492	Senior Seminar in Soil Science	1	
Departmental Electives		8	
Hours Required for Graduation			130

VETERINARY SCIENCE

Grinnells Animal Health Laboratory

Professor T. M. Curtin, Head of the Department

Professor D. J. Moncol, Coordinator of Advising

Professors: E. G. Batts, D. J. Moncol, D. G. Simmons; Associate Professor: R. C. Dillman; Assistant Professor: E. C. Hodgins; Associate Members of the Faculty: R. F. Behlow (Animal Science), J. R. Harris (Poultry Science), K. E. Muse

CURRICULUM

There is no program of study leading to the Bachelor of Veterinary Science degree. Members of the veterinary science faculty serve as advisors to undergraduates enrolled in the preveterinary curriculum and offer instruction at advanced undergraduate and graduate levels. Courses are designed to support other departments of the institution giving students a background in animal health, poultry health and laboratory animal care.

PREVETERINARY CURRICULUM

A preveterinary curriculum is offered under the science curriculum of Agriculture and Life Sciences as part of the North Carolina Veterinary Medical Education Program. After satisfactory completion of the preveterinary curriculum, North Carolina resident students are certified as eligible to seek admission to Auburn University, Ohio State University, Tuskegee Institute and other colleges of veterinary medicine in which the State may enter into agreements through the Southern Regional Education Board or other contracts for veterinary students to attend at in state tuition rates.

Preveterinary students work toward a Bachelor of Science degree in a discipline of their choice while fulfilling requirements of the preveterinary program. The choice of the degree program should be carefully considered to encompass alternate career objectives. If a student is accepted in a college of veterinary medicine before completion of his or her undergraduate degree, some course credits may be transferred from the veterinary program back to N. C. State and applied toward completion of the Bachelor of Science degree. Arrangements for this procedure should be made with the degree-granting department prior to entering veterinary college.

The courses listed below are minimum requirements for all students applying for entrance into veterinary college under contract arrangements.* A grade of C or better on each course and an overall grade point average of 2.7 on required courses are minimum requirements for certification by the North Carolina Certification Committee. Dr. E. W. Glazener, Director of Academic Affairs, serves as secretary of the N. C. Veterinary Certification Committee.

Preveterinary students should work closely with their advisers since these course requirements are subject to change at any time by contracting veterinary colleges.

<i>Languages</i>		<i>Semester Hours</i>
ENG 111, 112	English Composition	6
VET 333	Medical Vocabulary (for 6 sem. hrs. college credit in a foreign language)	2

Social Sciences/Humanities

A minimum of 18 semester hours is required by most schools of veterinary medicine and 21 hours are required for a B.S. degree at NCSU.

PS 201	American Governmental System	3
History or Literature	Two of the following history courses: HI 205, HI 207, HI 233 One World Literature: ENG 205 may be substituted for 3 hours of history	6

Additional Social Sciences/Humanities Electives

Physical and Biological Sciences

MA 111 or MA 114	Algebra and Trigonometry or Introduction to Finite Mathematics with Applications	4 or 3
MA 112	Analytic Geometry and Calculus A	4
CH 101	General Chemistry I	4
CH 107	Principles of Chemistry	4
CH 221, 223	Organic Chemistry I, II	8
PY 211, 212	General Physics	8
BS 100	General Biology	4
ZO 323 or ZO 203	Comparative Anatomy or Vertebrate Zoology	4
GN 111	Principles of Genetics	3

GIN 112	Elementary Genetics Laboratory	1
MB 111	General Microbiology	4
BC113.1	Elementary Biochemistry	3
BC11352	Elementary Biochemistry Laboratory	1

Upper Division Electives

ANS 24	Introduction to Animal Science (Recommended as a prerequisite for ANS 204 or 415)	4
ANS 28 (or 113)	Livestock Feeds and Feeding or Comparative Nutrition	3

* Based on requirements of Auburn University**

** Other State Universities, requirements differ from Auburn University requirements in that they strongly recommend courses in speech, communication, economics, sociology and psychology, but they do not have specific requirements for VET 414 PS 201, HI 205, HI 207 or HI 233.

** Tasktag - Institute requirements differ from Auburn University requirements in that they require PO 201 (Poultry Science) and Production, but do not have specific requirements for VET 333, PS 201, BC113.1, BC113.52 or MB 401.

ZOOLOGY

Gardner Hall

Professor J. G. Vandenberg, Head of the Department

Professor G. C. Miller, Coordinator of Advising

Professors: F. S. Barkalow Jr., P. C. Bradbury, W. W. Hassler, C. F. Lytle, G. C. Miller, T. L. Quay, J. F. Roberts, D. E. Smith *Alumni Professors:* J. B. Vandenberg, T. R. Rice, P. N. Witt; *Professors Emeriti:* B. B. Brandt, D. E. Davis; *Associate Professors:* G. T. Bartholmas, P. D. Doerr, J. D. Hair, M. T. Hunch (USDI), S. C. Moxley, K. E. Morse, J. M. Whitsett II; *Adjunct Associate Professors:* P. A. Cross, D. E. Gardner, G. R. Huntsman, G. W. Thayer; *Assistant Professors:* W. C. Grant, J. H. Kerley (USDI), J. M. Miller, L. A. Real, O. T. Sanders Jr., H. A. Underwood; *Adjunct Assistant Professors:* S. V. Chiavetta, R. L. Ferguson, D. F. Hoas, D. S. Peters, L. W. Reitor, R. McL. Shel ey; *Visiting Assistant Professors:* D. A. Lake, J. R. Lombardi, W. L. Rickards Jr.; *Instructor:* W. A. Luebke; *Visiting Instructors:* C. A. Doolittle, R. A. Graham, M. G. Jones, M. E. McDonald; *Adjunct Instructors:* W. B. Baker, R. B. Hamilton, R. B. Harp; *Associate Members of the Faculty:* B. J. Copeland (Botany), Sea Grant Program, D. S. Grosch, D. W. Hayne; *Statisticians:* T. G. Wolcott; *Marine Science and Engineering*

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 adequately 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. Basic training is also available for students planning to enter dentistry, medicine and veterinary medicine and allied health sciences, such as medical technology. Ecology is emphasized, including wildlife, fisheries, conservation, parasitology and marine science.

OPPORTUNITIES

Students may continue with graduate research work leading to advanced degrees in zoology and wildlife. However, numerous employment opportunities are available for Bachelor of Science graduates. Majors are qualified for positions in the medical sciences, various government agencies and private industries.

UNDERGRADUATE CURRICULA

The Bachelor of Science degree with a major in zoology, wildlife biology or medical technology is offered under the science curriculum of the School of Agriculture and Life Sciences. Within these majors a student may specialize depending upon interest and ability.

The zoology sequence prepares students for graduate school while the premedical, pre-dental and pre-veterinary options prepare students for entrance into these respective professional 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 options include the fisheries and marine science program and the medical technology program outlined below. The clinical year for the medical technology program is taken at an affiliated hospital. Students are advised by faculty in their specialty.

Basic requirements are listed in the science curriculum for the School of Agriculture and Life Sciences.

CURRICULUM IN ZOOLOGY

	<i>Credits</i>
ALS 108 Introductory Topics in the ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
Literature Elective	3
Language Elective	3
<i>Social Sciences and Humanities (21 Credits)</i>	
Electives	21
<i>Physical and Biological Sciences</i>	
MA 111 Algebra and Trigonometry	4
MA 112 Analytic Geometry and Calculus A	4
CH 101 General Chemistry I	4
CH 108 or CH 107 Gen. Ch. II or Prin- ciples of Chemistry	4
PY 211, 212 General Physics	8
or	
PY 221 College Physics	5
BS 100 General Biology	4
<i>Physical Education</i>	
Physical Education	4
<i>Free Electives</i>	
Free Electives	12

CURRICULUM IN WILDLIFE BIOLOGY

Professor J. D. Hair, Coordinator of Advising

	<i>Credits</i>
ALS 103 Introductory Topics in the ALS	1
<i>Languages (12 Credits)</i>	
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading	3
English Elective	3
Literature Elective	3
<i>Social Sciences and Humanities (21 Credits)</i>	
Electives	21
<i>Physical and Biological Sciences (40 Hours)</i>	
BO 200 Plant Life	4
BS 100 General Biology	4
CH 101 General Chemistry I	4
CH 103 General Chemistry II	4
MA 111 Algebra and Trigonometry	4
MA 112 Analytic Geometry and Calculus A	4
PY 221 College Physics	5
ZO 202 Invertebrate Zoology	4
ZO 203 Vertebrate Zoology	4
ST 311 Introduction to Statistics	3

<i>Group A Courses (27-31 Credits)</i>	
CH 220, BCH 351 Introductory Organic Chemistry, Elementary Biochemistry	7
or	
CH 221, CH 223 Organic Chemistry I, II	8
GN 411 The Principles of Genetics	3
GN 412 Elementary Genetics Laboratory	1
Restricted Electives	15-19
<i>Departmental Requirements and Electives (24 or 25 Credits)</i>	
ZO 202, ZO 203 Invertebrate Zoology, Vertebrate Zoology	8
or	
ZO 201, ZO 323 General Zoology, Comparative Anatomy	8
ZO 421 Vertebrate Physiology	3
or	
ZO 414 Cell Biology	3
ZO 415 Cellular and Animal Physiology Laboratory	2
ZO 360 Introduction to Ecology	4
or	
ZO 361 Vertebrate Embryology	4
Zoology Electives	3 or 4
Hours Required for Graduation	
	130

<i>Physical Education</i>	
Physical Education	4
<i>Free Electives</i>	
Free Electives	13
<i>Group A, B, C Courses (21 Hours)</i>	
BCH 351 Elementary Biochemistry	3
BO 403 Systematic Botany	4
CH 220 Introductory Organic Chemistry	4
GN 411 The Principles of Genetics	3
ZO 360 Introduction to Ecology	4
ZO 421 Vertebrate Physiology	3
<i>Departmental Requirements and Electives (18 Hours)</i>	
ENT (ZO) 425 General Entomology	3
ZO 221 Conservation of Natural Resources	3
ZO 353 Wildlife Management	3
ZO 420 Fishery Science	3
ZO 501 Ornithology or ZO 544 Mammalogy	3
ZO 553 Principles of Wildlife Science	3
Hours Required for Graduation	
	130

SCIENCE PROGRAM IN MEDICAL TECHNOLOGY

Professor G. C. Miller, Coordinator of Advising

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 for three years at North Carolina State University 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 N. C. State. 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 of the Board of Registry of Medical Technologists.

CURRICULUM IN MEDICAL TECHNOLOGY

		<i>Credits</i>
ALS 103	Introductory Topics in the Ag. & Life Sciences	1
<i>Languages (12 Credits)</i>		
ENG 111	Composition & Rhetoric	3
ENG 112	Composition & Reading	3
	Literature Elective	3
	English, Speech, or Language Elective	3
<i>Social Sciences & Humanities</i>		
Electives	(no more than two in any one Department)	21
<i>Physical and Biological Sciences</i>		
MA 111	Algebra and Trigonometry	4
MA 112	Analytic Geometry & Calculus A	4
CH 101	General Chemistry I	4
CH 107	Principles of Chemistry	4
PY 211	General Physics	4
BS 100	General Biology	4
ZO 201	General Zoology	4
<i>Physical Education</i>		
Physical Education	.....	4
<i>Free Electives</i>		
Free Electives	.....	12
<i>Group A, B, C Courses (26 or 27 Credits)</i>		
CH 220	Intro. Organic Chemistry and	4
BCH 351	Elem. Biochemistry	8
	or	
CH 221	Organic Chem. I & CH 223	
	Organic Chem. II	8
PY 212	General Physics	4
MB 401	General Microbiology	4
MB 411	Medical Microbiology	3
GN 411	The Principles of Genetics	3
GN 412	Elementary Genetics Laboratory	1
CH 315	Quantitative Analysis	4
	or	
CH 317	Quantitative Analysis for Life Science Students	
<i>Departmental Requirements and Electives</i>		
ZO 203	Vert. Zoology or ZO 212 Basic Anatomy and Physiology or ZO 323 Comparative Anatomy	4
ZO 421	Vert. Physiology or ZO 414 Cell Biology	3
<i>plus</i>		
<i>Twelve month course in Medical Technology at an affiliated hospital—40 to 30 credits transferred to NCSU</i>		
	Microbiology	Hematology
	Blood Bank	Serology
	Coagulation	Immunology
	Clinical Chemistry	Urinalysis
	Hours Required for Graduation	150

OPTIONS IN ZOOLOGY CURRICULUM

Students desiring to emphasize certain areas within zoology may choose an option:

CURRICULUM IN PREMEDICAL-PREEDENTAL OPTION

Professor W. C. Grant, Coordinator of Advising

<i>Credits</i>		<i>Free Electives</i>	
ALS 103	Introductory Topics in the Ag. & Life Sciences	1	
<i>Languages (12 Credits)</i>			
ENG 111	Composition & Rhetoric	3	
ENG 112	Composition & Reading	3	
	Literature Elective	3	
	Language Elective	3	
<i>Social Sciences & Humanities (21 Credits)</i>			
Electives	.....	21	
<i>Physical and Biological Sciences (28 Credits)</i>			
MA 111	Algebra and Trigonometry	4	
MA 112	Analytic Geometry & Calculus A	4	
CH 101	General Chemistry I	4	
CH 107	Principles of Chemistry	4	
PY 211	General Physics	4	
BS 100	General Biology	4	
ZO 201	General Zoology (Animal Life)	4	
<i>Physical Education</i>			
Physical Education	.....	4	

<i>Free Electives</i>		<i>Free Electives</i>	
Free Electives	.....	12	
<i>Group A Courses (26 Credits)</i>			
CH 221	Organic Chemistry I	4	
CH 223	Organic Chemistry II	4	
CH 315	Quantitative Analysis	4	
<i>or</i>			
CH 317	Quantitative Analysis for Life Science Students		
PY 212	General Physics	4	
GN 411	The Principles of Genetics	3	
GN 412	Elementary Genetics Laboratory	1	
Restricted Electives	.....	6	
<i>Departmental Requirements & Electives (26 Credits)</i>			
ZO 323	Comparative Anatomy	4	
ZO 415	Cellular & Animal Physiology Laboratory	2	
ZO 421	Vertebrate Physiology	3	
ZO 361	Vertebrate Embryology	4	
Restricted Electives	.....	13	
Hours Required for Graduation	.....	130	

CURRICULUM IN FISHERIES AND MARINE BIOLOGY OPTION

<i>Credits</i>		<i>Free Electives</i>	
ALS 103	Introductory Topics in Ag. & Life Science	1	
<i>Languages (12 Credits)</i>			
ENG 111	Composition & Rhetoric	3	
ENG 112	Composition & Reading	3	
	English Elective	3	
	Literature Elective	3	
<i>Physical and Biological Sciences (28 Credits)</i>			
MA 111	Algebra and Trigonometry	4	
MA 112	Analytic Geometry & Calculus A	4	
CH 101	General Chemistry I	4	
CH 103	General Chemistry II	4	
PY 221	College Physics	5	
BS 100	General Biology	4	
ZO 201	General Zoology*	4	
<i>or</i>			
ZO 203	Vertebrate Zoology	4	
<i>Physical Education</i>			
Physical Education	.....	4	
<i>Free Electives</i>			
Free Electives	.....	12	

<i>Free Electives</i>		<i>Free Electives</i>	
Free Electives	.....	12	
<i>Social Sciences & Humanities</i>			
Electives (no more than two in any one Department)	.....	21	
<i>Group A Courses (26 Credits)</i>			
CH 220	Introductory Organic Chemistry	4	
BCH 351	Elementary Biochemistry	3	
BCH 352	Elementary Biochemistry Lab	1	
ENT (ZO) 425	General Entomology	3	
GN 411	The Principles of Genetics	3	
ST 311	Introduction to Statistics	4	
Restricted Electives	.....	7	
<i>Departmental Requirements (27 Credits)</i>			
ZO 323	Comparative Anatomy	4	
<i>or</i>			
ZO 202	Invertebrate Zoology	4	
ZO 221	Conservation of Natural Resources	3	
ZO 420	Fishery Science	3	
ZO 421	Vertebrate Physiology	3	
ZO 360	Introduction to Ecology	4	
ZO 441	Ichthyology	3	
ZO 519	Limnology	4	
Fishery Elective	.....	3	
Hours Required for Graduation	.....	130	

* If ZO 201 is taken, then ZO 323 should be elected rather than ZO 202.

AGRICULTURAL EXPERIMENT STATION

J. E. Legates, *Dean of Agriculture and Life Sciences*

K. R. Keller, *Associate Dean and Director of Research*

The Agricultural Experiment Station is the agricultural and forestry research agency of the State of North Carolina. It is funded principally by appropriations from the North Carolina General Assembly and an allocation of federal funds.

The purpose of the Agricultural Experiment Station 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 Agricultural Experiment Station faculty brings well trained personnel to the University, whose teaching in many specialized fields of agriculture 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 on sound and economic planes.

PUBLICATIONS

The Agricultural Experiment Station publishes bulletins and scientific papers on research results conducted by the staff. Single copies of these publications are sent free upon request to anyone in the State.

SERVICES

The faculty and staff diagnoses and interprets problems for farmers and agribusiness firms in North Carolina. Station personnel counsel farmers and others interested in the agricultural and forestry industry, present radio and television programs devoted to the discussion of farm and forestry procedures, and write letters and articles on more specific problems of agriculture at the request of farmers, garden club members, newspapers, agricultural magazines and manufacturers of fertilizer and pesticides. Researchers also take part in administrative functions of the University.

AGRICULTURAL EXTENSION SERVICE

J. E. Legates, *Dean of the School of Agriculture and Life Sciences*

T. C. Blalock, *Associate Dean and Director of the Agricultural Extension Service*

The Agricultural Extension Service of North Carolina State University is a cooperative undertaking among the United States Department of Agriculture, the State of North Carolina and the 100 counties in the State. Its work is supported by federal funds made available under the Smith-Lever Act of 1914, as amended, and by state and county appropriations.

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 Agricultural 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 agricultural production and marketing; family living; 4-H and youth; and, community and natural resource development.

The primary purpose of the North Carolina Agricultural Extension Service is to take to the people of the State the latest and best information obtainable particularly that which is related to agriculture; 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. Educational assistance is given to individuals, families, industrial processing and marketing firms, other businesses and certain organizations. This includes work with adult men and women and boys and girls 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 Experiment Stations in this and other states and by the United States Department of Agriculture.

AGRICULTURAL INSTITUTE

Patterson Hall

J. E. Legates, *Dean of Agriculture and Life Sciences*

E. W. Glazener, *Associate Dean and Director of Academic Affairs*

H. B. Craig, *Associate Director of Academic Affairs and Director of the Agricultural Institute and Coordinator of Advising.*

The Agricultural Institute is a two-year, terminal academic program which provides training in agriculture and related areas. It is part of the School of Agriculture and Life Sciences at North Carolina State University. This program was begun in 1959 and was funded by legislative appropriation.

Its objective is to train those desiring a comprehensive education in agriculture and agribusiness.

Individuals with Institute training command attractive salaries, assume a more prominent role of leadership and become a distinct asset to various segments of agricultural society. They make significant contributions to their community, state and nation by being involved in the world's most vital industry.

The instructional programs are organized and conducted as a part of the over all resident instruction program for Agriculture and Life Sciences. The Institute is an addition to and not a substitute for, the School's regular degree granting program. However, the faculty in residence for the four-year programs are responsible for organizing and teaching courses offered by the Institute.

People with training similar to that of the Institute are in demand by agricultural industries. As demand changes, courses will be evaluated and alterations will be made accordingly. Such a re-evaluation also aids the technical manpower needs of agricultural industry.

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, flowers 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 larger work force. This work force must be able to deal with a vast array of problems and opportunities and Institute graduates can assume responsible positions in the total agricultural industry. Some career examples are: farm and herd managers, research technicians, salesmen, retail farm supply and equipment outlet managers, golf course superintendents, nursery managers, agricultural pest control specialists, quality control technicians, food service supervisors and others. More job opportunities than graduates make salaries attractive.

The School maintains a 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 State Department of Public Instruction is eligible for admission consideration. Each application will be reviewed and evaluated by the Institute director.

For additional information write: Director, Agricultural Institute, 107 Patterson Hall, N.C. State University, Raleigh, N.C. 27650.

PROGRAMS OF STUDY

Graduates of the Agricultural Institute are awarded the Associate in Applied Agriculture degree. The 10 programs of study are: Agricultural Equipment Technology; Agricultural Pest Control; Field Crops Technology; Flower and Nursery Crops Technology; Food Processing, Distribution and Service; General Agriculture; Livestock Management and Technology (animal husbandry option and dairy husbandry option); Soil Technology; and Turfgrass Management.



The cosmopolitan student body at State includes Americans of every group and students from nearly 70 countries.

SCHOOL OF DESIGN

Brooks Hall

C. E. McKinney, *Dean*

R. H. Clark, *Assistant Dean*

M. LoPresti, *Librarian*

P. Batchelor, *Coordinator of Advising*

The School of Design, since its beginning in 1948, has addressed design in the broadest sense involving the disciplines of architecture, landscape architecture, product and visual design 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, professional and otherwise, is equaled by the varied interests possessed by our students. Through a selective admissions process, the School's student population is highly motivated and heterogeneous. Our faculty represents an equally broad spectrum of educational 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, landscape architecture, product and visual design within a program 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, landscape architecture, product design and product design with a visual design option.

The learning activities for our students are divided into three curriculum areas: (1) general courses including English, mathematics, social science, humanities, physical science and other University courses; (2) core courses which deal with bodies of knowledge and skills applicable to design and common to all disciplines; 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, these studios relate to the student's declared disciplinary major. The flexibility of this curriculum plan affords the student the greatest 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 designers relate to a broad range of design and development professionals not in isolation.

Graduate studies are also offered in architecture, landscape architecture and product design. See the Graduate Catalog for information on the Master's programs.

DESIGN FUNDAMENTALS

Brooks Hall

Associate Professor M. Pause, Program Director

Professors: G. L. Bireline, J. H. Cox, D. R. Stuart; Assistant Professors: C. Joyner, S. Toplikar

The design fundamentals program is focused on exposure to basic design concepts and provides counseling, orientation and an historical structure for the fields of design in general and for future studies in the School and the University. The student develops through exploration and investigation of physical form.

ARCHITECTURE

Brooks Hall

Professors: P. Batchelor, R. P. Burns, R. H. Clark, J. Loss, H. Sanoff, V. Shogren; Professors Emeriti: H. H. Harris, H. L. Kamphoefner; Associate Professors: M. Pause, G. J. P. Reuter, E. W. Taylor; Assistant Professors: D. W. Barnes, J. P. Rand, L. Sanders, J. O. Tector, P. Tesar

Architecture finds itself at a critical stage in its historical development. The architect's traditional role of giving meaningful form to our physical environment remains a chief concern, but this task has been vastly complicated by the forces of accelerating world urbanization. The evolution of society in social and technological terms rapidly alters every facet of contemporary life. The changing conditions in our urban centers have modified attitudes about obsolescence and inefficiency in all of our life support systems, including housing, transportation, commerce, and numerous others. We are looking at our environment in different terms with innovation, conservation, preservation and adaptive use of our existing man-made forms to meet society's changing needs. The architecture program attempts to prepare individuals with an understanding of man and his cultural context with a commitment to the ordering of the physical environment and with the tools for accomplishing these objectives.

The curriculum, while providing a broad basic structure common to all students, encourages individual diversity through a major elective program of in-depth study in one of the several design related fields, through interdisciplinary studies in the School and the University, and through the use of outside consultants. The interdependence of the architect with related professionals is strongly emphasized. The design studio is a working laboratory in which analysis and synthesis become real and meaningful activities to the students. Considering the expanding requirements in the field of architecture and the increasing complexity of the architect's role, a six-year, two-degree curriculum has been established. After a common first year in design fundamentals, the sophomore, junior and senior years mark the formal introduction to architectural studies and lead to the undergraduate, non-professional degree, the Bachelor of Environmental Design in Architecture. For students not advancing to graduate studies, the four-year undergraduate curriculum is designed as a terminal program qualifying students to enter architecture at an intermediate level or related fields outside of architecture. Students who later wish to pursue the professional, accredited degree in architecture must enroll in the Master of Architecture program. See the Graduate Catalog for information on the Master's program.

OPPORTUNITIES

The graduate with a Bachelor of Environmental Design in Architecture is qualified for positions in public agencies, development organizations, building research, building construction firms and private architectural offices. State law now requires the graduate with an accredited, professional degree in architecture to work not less than three years in the offices of registered architects and then pass a written examination given by the North Carolina Board of Architecture prior to being licensed as an "architect". Graduates with the non-professional Bachelor's degree have additional work and examination requirements which vary with State laws.

ARCHITECTURE CURRICULUM

Degree: Bachelor of Environmental Design in Architecture

FIRST YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 101 Environ. Des. I	6	DF 102 Environ. Des. II	6
Soc. Sci./Hum. ¹	3	Soc. Sci./Hum. ¹	3
ENG 111 Comp. & Rhet.	3	ENG 112 Comp. & Read.	3
Math ²	3	Math ³	4/3
Phy. Ed.	1	Phy. Ed.	1
	16		17/16

SECOND YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Studio ²	6	Studio ²	6
Nat. Science Elec. ³	4	Nat. Science Elec. ³	4
Soc. Sci./Hum. Elect. ⁴	3	Soc. Sci./Hum. Elec. ⁴	3
Core ⁵	3	Core ⁶	3
Phy. Ed.	1	Phy. Ed.	1
	17		17

THIRD YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Studio ²	6	Studio ²	6
Soc. Sci./Hum. ¹	3	Soc. Sci. Hum. ¹	3
Advised Elec. ⁷	3	Advised Elec	3
Core ⁸	3	Core ⁸	3
Core ⁹	3		
	18		15

FOURTH YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Advised Elec. ⁷	3	Free Elec.	3
Free Elec.	3	Free Elec.	3
Free Elec.	3	Core ⁹	3
Core ⁸	3	Core ⁹	3
Core ⁸	3	Core ⁸	3
	15		15

Minimum Hours Required for

Graduation 129*

Must include one calculus course and may include one computer science course. May not include credit for Math 111.

¹ A minimum of four 400 series studios are required with a minimum of three of the four being ARC 400. The four studios may be taken at any time during the final six semesters; however, no more than one studio may be taken in any semester. Selected from natural, physical, or biological sciences, but not to include math or computer science courses.

² The University requires 18 hours in social science/humanities area. The courses are not limited to any specific department but are to show a distribution between the social sciences and humanities. May include any courses which have humanities or social science orientation normally elected from DN 141, DN 142, Anthropology (ANT), Economics and Business (ACC, EB), Foreign Languages (GRK, LAT, FLP, FLG, FLI, FLR, FL-S), History (HI), Literature (ENG), Philosophy (PHI), Political Science (PS), Psychology (PSY), Religion (REL), Social Work (SW), Sociology (SOC), and University Studies (UNI).

³ Advised electives are to be selected after consultation with the advisor. They may include studios and core courses from the School of Design or courses from the University at large but may not include credit for Art (ART), Military Science (AS, MS), Music (MUS) below 200 level, or Physical Education (PE).

⁴ Each architecture student is required to take a minimum of one entry course in four of the six cores (Graphics and Communications, Behavior, Environment, History and Philosophy, Physical Elements and Systems, and Methods and Management). DF 101 and DF 102 satisfy this requirement for the Communications and Graphics Core, DN 141 and DN 142 satisfy this requirement for the History and Philosophy Core. In the remaining cores the entry courses are designated by "2" as the first digit in the course number. *Note:* A student in this program must have an architecture faculty member as advisor. In order to receive two degrees from School of Design a student must complete 30 credit hours above the 129 hour requirement. These 30 hours are to include 18 credits in 400 level studio and 12 credits in core courses above those described above.

LANDSCAPE ARCHITECTURE

Associate Professor A. Sullivan, Program Director

Professor: R. Stipe, R. R. Wilkinson, Prof. of Emeritus: E. G. Thurlow, 15 Credit Professors: A. Abbate, R. T. Hester, Jr., 15 Credit Professors: G. G. Gutz, L. Jewell, D. Wood, Associate Merchants: Dr. Fred T. O. Perry (Forestry), J. C. Kaulstad (Architecture)

Landscape architecture is the profession concerned with design and development of man-made features on the land and enhancement of the visual landscape, seeking to shape these features in concert with the natural environment. There are approximately 8,000 practicing landscape architects in the United States whose activities range from site planning for urban complexes, community design, park and open space design, to campus planning and development of regional land management systems. U.S. Forest Service, National Park Service, city planning, state and local park agencies and private design offices are major employment sources. Types of work range from program development studies to detailed projects. The landscape architecture faculty is concerned with preparing students for graduate work and professional careers.

OPPORTUNITIES

Graduates of the program with a Bachelor of Environmental Design in Landscape Architecture gain employment with private offices practicing all phases of landscape architecture. Others gain employment with public agencies such as state park departments, community planning offices and environmental protection agencies. Many stay in North Carolina and participate in the expansion of the profession and its involvement in the development of the State. For a growing number of BED-LA graduates, a graduate professional degree offers an important career benefit.

LANDSCAPE ARCHITECTURE CURRICULUM

Degree: Bachelor of Environmental Design in Landscape Architecture

FIRST YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 111 Environ. Des. I	6	DF 112 Environ. Des. II	6
Soc. Sci. Hum.	3	Soc. Sci. Hum.	3
ENG 111 Comp. & Rhet.	3	ENG 112 Comp. & Read.	3
Math	3	Math	4
Phy. Ed.	1	Phy. Ed.	1
	16		17

SECOND YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Stu. I	6	Stu. II	6
Nat. Science Elec.	4	Nat. Science Elec.	4
Soc. Sci. Hum. Elec.	3	Soc. Sci. Hum. Elec.	3
Core	3	Core	3
Phy. Ed.	1	Phy. Ed.	1
	17		17

THIRD YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Studio	6	Studio	6
Soc. Sci. Hum.	3	Soc. Sci. Hum.	3
Advised Elec.	3	Advised Elec.	3
Core	3	Core	3
Core	3		15
	18		

FOURTH YEAR

Fall Semester	Credits	Spring Semester	Credits
Advised Elec.	3	Free Elec.	3
Free Elec.	3	Free Elec.	3
Free Elec.	3	Core ^a	3
Core ^a	3	Core ^a	3
Core ^a	3	Core ^a	3
	15		15

Minimum Hours Required for
Graduation129

Must include one calculus course and may include one computer science course. May not include credit for Math 111.

^a A minimum of four 400 series studios are required with a minimum of three of the four being LAR 400. The four studios may be taken at any time during the final six semesters, however, no more than one studio may be taken in any semester. Selected from natural, physical, or biological sciences, but not to include math or computer science courses.

^b The University requires 18 hours in social science/humanities area. The courses are not limited to any specific department but are to show a distribution between the social sciences and humanities. May include any courses which have humanities or social science orientation normally elected from DN 141, DN 142, Anthropology (ANT), Economics and Business (ACC, EB), Foreign Languages (GRK, LAT, FLF, FLC, FLI, FLR, FLS), History (HI), Literature (ENG), Philosophy (PHI), Political Science (PS), Psychology (PSY), Religion (REL), Social Work (SW), Sociology (SOC), and University Studies (UNI).

^c Advised electives are to be selected after consultation with the advisor. They may include studios and core courses from the School of Design or courses from the University at large but may not include credit for Art (ART), Military Science (AS, MS), Music (MUS) below 200 level, or Physical Education (PE).

^d Each landscape architecture student is required to take a minimum of one entry course in four of the six cores (Graphics and Communications, Behavior, Environment, History and Philosophy, Physical Elements and Systems, and Methods and Management). DF 101 and DF 102 satisfy this requirement for the Communications and Graphics Core, DN 141 and DN 142 satisfy this requirement for the History and Philosophy Core. In the remaining cores the entry courses are designated by "2" as the first digit in the course number.

^e Note: A student in this program must also take the following which satisfy core requirements: DN 221/231, DN 430 (3 credits above entry level in Behavior Core, 3 credits above entry level in Environment Core), and either DN 443 or DN 444.

^f In order to receive two degrees from School of Design a student must complete 90 credit hours above the 129 hour requirement. These 90 hours are to include 18 credits in 400 level studio and 12 credits in core courses above those described above.

PRODUCT DESIGN

Brooks Hall

Professor V. M. Foote, Program Director

Associate Professors: A. V. Cooke, J. Wittkamp; Assistant Professors: A. Donaldson, J. Keely, C. Kieffer

Upon completion of design fundamental requirements, the student selecting the Product Design Program elects as a major area of concentration the product or visual design option. The product design option is concerned with all the human aspects of machine-made products and their relationship to the environment. In some areas, this design discipline is referred to as industrial design. The designer is responsible for the product's human engineering, safety, shape, color, texture, maintenance and cost. Product design deals with consumer products as well as industrial products. In order to achieve these ends, it is necessary for the designer to involve himself or herself in three major design and research activities: man's behavior; the man-product-machine relationship; the product itself.

Areas of investigation include furniture, housewares, appliances, transportation, machine tools, farm equipment, medical electronic instruments, recreational support equipment and others.

OPPORTUNITIES

Graduates with a Bachelor of Environmental Design in Product Design have career opportunities in three general areas: corporate design offices in manufacturing companies, independent design offices, or governmental agencies.

PRODUCT DESIGN CURRICULUM

Degree: Bachelor of Environmental Design in Product Design

FIRST YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 101 Environ. Des. I	6	DF 102 Environ. Des. II	6
Soc. Sci./Hum. ¹	3	Soc. Sci./Hum. ¹	3
ENG 111 Comp. & Rhet.	3	ENG 112 Comp. & Read.	3
Math	3	Math ²	4/3
Phy. Ed.	1	Phy. Ed.	1
	16		17/16

SECOND YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Studio	6	Studio	6
Nat. Science Elec. ³	4	Nat. Science Elec. ³	4
Soc. Sci./Hum. Elec. ⁴	3	Soc. Sci./Hum. Elec. ⁴	3
Core ⁵	3	Core ⁵	3
Phy. Ed.	1	Phy. Ed.	1
	17		17

THIRD YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Studio ²	6	Studio ²	6
Soc. Sci./Hum. ⁴	3	Soc. Sci./Hum. ⁴	3
Advised Elec. ⁶	3	Advised Elec. ⁶	3
Core ⁵	3	Core ⁵	3
Core ⁷	3		15
	18		

FOURTH YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Advised Elec. ⁶	3	Free Elec.	3
Free Elec.	3	Free Elec.	3
Free Elec.	3	Core ⁸	3
Core ⁸	3	Core ⁸	3
Core ⁸	3	Core ⁸	3
	15		15

Minimum Hours Required for
Graduation129⁸

¹ Must include one calculus course and may include one computer science course. May not include credit for Math 111.
² A minimum of four 400 series studios are required with a minimum of three of the four being PD 400. The four studios may be taken at any time during the final six semesters; however, no more than one studio may be taken in any semester.
³ Selected from natural, physical, or biological sciences, but not to include math or computer science courses.
⁴ The University requires 18 hours in social science/humanities area. The courses are not limited to any specific department but are to show a distribution between the social sciences and humanities. May include any courses which have humanities or social science orientation—normally selected from DN 141, DN 142, Anthropology (ANT), Economics and Business (ACC, EB), Foreign Languages (GRK, LAT, FLF, FLG, FLI, FLR, PLS), History (HI), Literature (ENG), Philosophy (PHI), Political Science (PS), Psychology (PSY), Religion (REL), Social Work (SW), Sociology (SOC), and University Studies (UNI).
⁵ Advised electives are to be selected after consultation with the advisor. They may include studios and core courses from the School of Design or courses from the University at large but may not include credit for Art (ART), Military Science (AS, MS), Music (MUS) below 200 level, or Physical Education (PE).
⁶ Each product design student is required to take a minimum of one entry course in four of the six cores (Graphics and Communication, Behavior, Environment, History and Philosophy, Physical Elements and Systems, and Methods and Management). DF 101 and DF 102 satisfy this requirement for the Communications and Graphics Core; DN 141 and DN 142 satisfy this requirement for the History and Philosophy Core. In the remaining cores the entry courses are designated by "2" as the first digit in the course number. Note: A student in this program must also take the following which satisfy the core requirements: DN 256 and DN 256.
⁷ In order to receive two degrees from School of Design a student must complete 30 credit hours above the 129 hour requirement. These 30 hours are to include 18 credits in 400 level studio and 12 credits in core courses above those described above.

VISUAL DESIGN OPTION

The increasing importance of communication in our society has created a demand for designers who have operational knowledge and creative abilities in various visual media. The elements of this field were historically found in various crafts, skills, commercial and production art. These have been integrated into a new design discipline; and the scope of educational development includes typography, photography, illustration, printing, production materials and methods. The applications include publication design (books, pamphlets and brochures), package design, signing and symbol design, advertising design (including newspapers, magazines, television and cinema), exhibit and display design. In relation to a broader view of the environment, the discipline includes the development of techniques for analyzing the visual character of our urban environment and its relation to social and behavioral functions; also, the exploration of visual means for solving socially defined problems. Working through a broad range of visual creative experiences, the student will develop an understanding of the elements and principles of organization common to all visual communication.

OPPORTUNITIES

Graduates with a Bachelor of Environmental Design in Product Design with the Visual Design Option pursue varied careers in professional design offices, corporate design offices, advertising agencies, corporations involved in printing, production, media development and communication. Others choose to enter graduate school for continued study in specific areas, both natural and man-made.

PRODUCT DESIGN/VISUAL DESIGN OPTION

Degree: Bachelor of Environmental Design in Product Design/Visual Design Option

FIRST YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
DF 101 Environ. Des. I	6	DF 102 Environ. Des. II	6
Soc. Sci./Hum.*	3	Soc. Sci./Hum.*	3
ENG 111 Comp. & Rhet.	3	ENG 112 Comp. & Read.	3
Math ¹	3	Math ¹	4/3
Phy. Ed.	1	Phy. Ed.	1
	16		17/16

SECOND YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Studio ¹	6	Studio ²	6
Nat. Science Elec. ¹	4	Nat. Science Elec. ¹	4
Soc. Sci./Hum. Elec.*	3	Soc. Sci./Hum. Elec.*	3
Core ²	3	Core ²	3
Phy. Ed.	1	Phy. Ed.	1
	17		17

THIRD YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Studio ¹	6	Studio ²	6
Soc. Sci./Hum.*	3	Soc. Sci./Hum.*	3
Advised Elec. ³	3	Advised Elec. ³	3
Core ²	3	Core ²	3
Core ⁴	3		15
	18		

FOURTH YEAR

Fall Semester	Credits	Spring Semester	Credits
Advised Elec. ⁵	3	Free Elec.	3
Free Elec.	3	Free Elec.	3
Free Elec.	3	Core ⁶	3
Core ⁶	3	Core ⁶	3
Core ⁶	3	Core ⁶	3
	15		15

Minimum Hours Required for
Graduation 129⁷

- ⁵ Must include one calculus course and may include one computer science course. May not include credit for MA 111.
- ⁶ A minimum of four 400 series studios are required with a minimum of three of the four being PVD 400. The four studios may be taken at any time during the final six semesters; however, no more than one studio may be taken in any semester.
- ⁷ Selected from natural, physical, or biological sciences, but not to include math or computer science courses.
- ⁸ The University requires 18 hours in social science/humanities area. The courses are not limited to any specific department but are to show a distribution between the social sciences and humanities. May include any courses which have humanities or social science orientation—normally elected from DN 141, DN 142, Anthropology (ANT), Economics and Business (ACC, EB), Foreign Languages (GRK, LAT, FLF, FLG, FLI, FLR, FLS), History (HI), Literature (ENG), Philosophy (PHI), Political Science (PS), Psychology (PSY), Religion (REL), Social Work (SW), Sociology (SOC), and University Studies (UNI).
- ⁹ Advised electives are to be selected after consultation with the advisor. They may include studios and core courses from the School of Design or courses from the University at large but may not include credit for Art (ART), Military Science (AS, MS), Music (MUS) below 300 level, or Physical Education (PE).
- ¹⁰ Each visual design student is required to take a minimum of one entry course in four of the six cores (Graphics and Communications, Behavior, Environment, History and Philosophy, Physical Elements and Systems, and Methods and Management). DF 101 and DF 102 satisfy this requirement for the Communications and Graphics Core. DN 141 and DN 142 satisfy this requirement for the History and Philosophy Core. In the remaining cores the entry courses are designated by "2" as the first digit in the course number. *Note:* A student in this program must also take the following which satisfy the core requirements: DN 415 and DN 416.
- ¹¹ In order to receive two degrees from School of Design a student must complete 30 credit hours above the 129 hour requirement. These 30 hours are to include 18 credits in 400 level studio and 12 credits in core courses above those described above.



Outstanding professors with a zest for teaching are honored annually at State, adding thrust to the University's emphasis on excellence.

SCHOOL OF EDUCATION

Poe Hall

C. J. Dolce, Dean

R. T. Williams, *Associate Dean*

The School of Education is concerned with the problems of human development from both psychological and educational perspectives. With emphases upon the preparation of secondary and post-secondary school teachers, counselors, administrators and psychologists, the school 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 School 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. The School also houses a national research center, the Center for Occupational Education.

Undergraduate degree programs are offered in agricultural education, education-general studies, industrial arts education, mathematics education, science education, social studies education, technical education, vocational industrial education, and psychology. In addition to being admitted to a curriculum, all teacher education candidates must meet program and Committee on Teacher Education requirements for admission to professional education.

Professional education courses are provided for those students enrolled in the School of Humanities and Social Sciences who wish to become teachers of English, social studies, French, and Spanish. Students enrolled in the School of Agriculture and Life Sciences and science or mathematics departments may double-major in the School of Education and also obtain a North Carolina teacher's certificate.

Graduate degree programs are offered in adult and community college education, agricultural education, counselor education, curriculum and instruction, educational administration and supervision, industrial arts education, mathematics education, occupational education, psychology, science education, special education, and vocational industrial education.

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 fields. Graduates of the undergraduate program in psychology receive a Bachelor of Arts in Psychology degree. Graduate programs confer the Master of Science or Master of Education degree, and the Doctor of Philosophy or Doctor of Education degrees.

Public school sixth-year (intermediate) certification programs are available in agricultural, occupational, and vocational industrial education; curriculum and instruction and supervision; administration; counseling; special education; mathematics and science education; and school psychology.

The modern School of Education building is named Poe Hall. It includes a curriculum materials center, an instructional materials production center, a computer facility, and a learning assistance center. The building houses laboratories for industrial arts, science, psychology, and guidance and testing activities, as well as a children's play area with an observation room. A closed circuit TV system with a studio has also been designed into the building.

ADULT AND COMMUNITY COLLEGE EDUCATION

(Also see Agriculture and Life Sciences.)

Poe Hall and Ricks Hall

Professor E. J. Boone, Head of the Department

Professor R. W. Shearon, Associate Head

TEACHING, RESEARCH AND EXTENSION

Professors: M. Burt, M. Knowles, C. Trent, *Extension Professors:* W. L. Carpenter, J. D. George, D. L. Stormer, *Adjunct Professors:* J. P. Leagans, I. E. Ready Sr., *Associate Professors:* J. C. Glass, W. L. Gragg, J. W. Wright, *Extension Associate Professors:* C. Black, M. Brown, P. E. Dew, D. W. Smith, *Visiting Associate Professors:* J. M. Stewart, E. White, *Assistant Professors:* J. L. Compton, R. A. Mabry, K. B. Siegner III

The adult and community college education faculty offers instruction at advanced undergraduate and graduate levels. Advanced undergraduate courses are designed to support other departments of the institution, giving students a background in adult and community college education. The department does not have a program leading to a bachelor's degree.

The graduate program is designed to increase the professional competence of adult and community college educators in developing and administering adult and community college education programs and in conducting scholarly research in the field. See listing of graduate degrees and the Graduate Catalog.

AGRICULTURAL EDUCATION

Poe Hall

Associate Professor: T. R. Miller, *Coordinator of Advising*

Professors Emeriti: J. R. Kirkland, C. C. Searborough, *Associate Professor:* C. D. Bryant, *Assistant Professor:* L. R. Jewell, *Adjunct Assistant Professor:* W. R. Robinson

Agricultural education, in its broadest sense, encompasses areas of study which will enable one to participate effectively in planning, promoting and initiating programs in education in agriculture.

The department offers a program leading to a Bachelor of Science degree. Programs are designed for the teachers of vocational agriculture in the secondary schools, technical institutes and community colleges. For details of the master's degree programs see listing of graduate degrees and consult the Graduate Catalog.

OPPORTUNITIES

The demand for agricultural education teachers exceeds present supply. Graduates who obtain certification in the Bachelor's degree program generally have a choice of positions in the Carolinas and Virginia and throughout the nation.

AGRICULTURAL EDUCATION CURRICULUM

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 111 Alg. & Trig.	4	Math Elective**	3
History Elective	3	PO or ANS Elective	4
Ag. Elective	3, 4	BS 100 Gen. Biology	4
ED 102 Obj. in Ag. Ed.	1	Physical Education	1
Physical Education	1		15
	15 16		
SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Free Elective	3	BAE 211 Farm Machinery	3
EB 212 Econ. of Agr.	3	"E" Elec. in Agr.	3
EB 201 Economics I	3	CH 103 Gen. Chem. II	4
CH 101 Gen. Chem. I	4	ED 313 Cont. Vo. Ag.	3
Plant Sc. Elective*	3, 4	SOC 241 Rural Soc. USA or	
Ag. Elective	3, 4	SOC 202 Prin. of Soc.	3
Physical Education	1	Physical Education	1
	17 19		17

JUNIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
BAE 201 Shop Practices	2	SSC 200 Soil Science	4
Ag. Specialty***	3, 4	Lit Elective	3
ED 344 School & Society	3	PSY 476 Psy. of Ad. Dev. or	3
PSY 304 Educational Psy.	3	PSY 376 Human Gro. & Dev	3
Free Elective	3	Ag. Specialty***	3, 4
"A" or "B" Elective	3	Speech Elective	3
in Agriculture****	3, 4	ED 490 Sr Seminar, AED	1
	17-19		17-18

SENIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
ED 401 Improving Reading in Secondary Schools	2	Humanities Elective*****	3
ED 411H Student Teaching in Agriculture	8	Ag. Specialty***	3
ED 412H Teaching Adults	2	Humanities Elective*****	3
ED 413H Planning Ed. Prog.	2	Pol. Sc. Elective	3
SOC 416A Research Methods	3	Free Elective	3
	1*		15
		Hours Required for Graduation	130

* Includes courses in Crop Science, Horticulture or Forestry

** Select from MA courses above MA 111 level or computer science

*** These three courses, when related to other ALS courses, should total a minimum of 12 semester hours for a "specialty" in ALS

**** Select from "A" or "B" electives in agriculture and related to "specialty." Consult Undergraduate Catalog for listing of "A" and "B" courses in School of Agriculture and Life Sciences

***** Humanities electives should be selected from the fine arts, philosophy, history, literature, languages and/or religion.

COUNSELOR EDUCATION

Poe Hall

Professor W. E. Hopke, Head of the Department and Coordinator of Advising

Professor Emeritus C. G. Morehead, Associate Professors L. K. Jones, B. C. Talley Jr., Assistant Professors E. R. Geiler, D. C. Locke, J. G. McVay, Visiting Assistant Professor T. H. Stafford Jr., Adjunct Assistant Professors R. H. Massengill, C. L. Quinn

The department offers work leading to graduate degrees (see listing of graduate degrees offered) with a major in Counselor Education. The degrees are designed to prepare individuals for counseling and student personnel positions at various levels in elementary and secondary schools, junior and community colleges, trade and technical schools and institutes, other institutions of higher education, and community agencies. For further information consult the Graduate Catalog.

CURRICULUM AND INSTRUCTION

Associate Professor B. M. Parramore, Head of the Department and Coordinator of Advising

Coordinators of Advising

*English Education: T. N. Walters and L. J. Betts,
Modern Foreign Language Education: B. M. Parramore
Reading Education: B. J. Fox,
Social Studies Education: C. W. Harper, Jr.,
Special Education: C. L. Crossland.*

Faculty: Adjunct Professor: T. L. Roundtree, Associate Professors: L. J. Betts, C. W. Harper Jr., T. N. Walters, Associate Professor Emeritus: P. J. Rust; Assistant Professors: C. L. Crossland, B. J. Fox, T. S. Hasselbring, M. D. Siedow, Assistant Prof. or Emeritus: K. A. McCutchen, Adjunct Assistant Professor: L. G. Aulrecht

The Department of Curriculum and Instruction offers general courses required for all teacher educational programs. It also offers social studies education and English, French, and Spanish education for teacher certification.

OPPORTUNITIES

Students earning a degree in this program generally have the same options as graduates of related programs: teaching in secondary schools, graduate study, or employment in governmental and private agencies involved in formal or non-formal education.

GRADUATE STUDY

The Department of Curriculum and Instruction offers graduate programs designed to prepare directors of instruction/curriculum development and the teaching-learning process. See listing of graduate degrees offered and consult the Graduate Catalog.

SPECIAL EDUCATION

Assistant Professor C. L. Crossland, Coordinator of Advising

Assistant Professor T. S. Hasselbring; Assistant Professor Emerita K. A. McVutchen

The program in special education is designed for educators who wish to pursue advanced study relating to the learning problems and the education of children and youth. This program offers a general background in all areas of exceptionality, intellectual, physical and emotional, with specialization in mental retardation and sensory impairment. There is no undergraduate program in this field at North Carolina State University, but graduate degrees are offered. For further information consult the Graduate Catalog.

EDUCATIONAL LEADERSHIP AND PROGRAM EVALUATION

Professor C. J. Dolce, Coordinator of Advising

Associate Professor B. G. Beezer; Assistant Professors J. J. Davies, R. C. Serow, R. T. Williams; Adjunct Assistant Professor F. S. Romero

There is no undergraduate program in this field. Graduate programs in Educational Administration and Supervision are individually designed by the student in consultation with the program staff (see listing of graduate degrees offered). These programs prepare the student for a variety of administrative, supervisory and policy-making roles in public schools, higher education, and other education agencies. For further information, consult the Graduate Catalog.

INDUSTRIAL ARTS EDUCATION

Poe Hall

Associate Professor T. B. Young, Coordinator of Advising

Professors Emeriti: I. Heutler, D. W. Olson; Associate Professor R. E. Wenig; Assistant Professors: W. L. Cox Jr., R. T. Trosler

Industrial arts comprises that area of education which concerns itself with materials, processes and products of industry, including the graphical presentation of these. It is concerned with a study of changes made in materials to make them more useful and with problems related to these changes.

The industrial arts education curriculum performs the function of preparing teachers and supervisors of industrial arts for secondary schools.

OPPORTUNITIES

The graduates of the industrial arts program find opportunities for employment in the public schools. See listing of graduate degrees offered and consult the Graduate Catalog.

INDUSTRIAL ARTS EDUCATION CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
IA 111 Intro. to Industrial Arts	1	IA 122 Metal Technology I	3
E 101 Engineering Graphics I	2	SOC 202 Prin of Sociology	3
IA 115 Wood Processing I	3	MA Elective	3
MA 111 Algebra and Trigonometry	4	ENG 112 Composition and Reading	3
ENG 111 Composition and Rhetoric	3	Humanities or Soc. Sciences	3
Physical Education	1	Physical Education	1
	14		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
IA 231 Industrial Arts Design	3	IA 246 Graphic Technology	3
CH 111 Foundations of Chemistry	4	PY 221 College Physics	5
ENG Literature Elective	3	PSY 304 Educational Psychology	3
Economics Elective	3	ED 242 Intro to Teaching Ind Arts	3
IA 233 Metal Technology II	3	Elective	3
Physical Education	1	Physical Education	1
	17		18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
IA 359 Electrical Technology I	3	ED 362 Curr & Methods in Industrial Arts	4
PSY 376 Human Growth & Development	3	IA 368 Technical Drawing II	3
IA 351 General Ceramics I	3	IA 364 Wood Processing II	3
ED 344 School and Society	3	IA 360 Electrical Technology II	3
Electives	3	Elective Speech	3
	15		16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ED 473 Student Teaching in Ind Arts	8	ED 451 Improving Reading in Secondary Schools	2
ED 479 Industrial Arts Laboratory Planning	3	Electives	3
IA 476 Power Technology	3	Political Science or History	3
	14	IA 48 Modern Industries	3
		Humanities or Soc. Sci.	3
			17
		Hours Required for Graduation	127

To be certified for Middle Grades, Occupational Education students are advised to elect ED 522 Career Exploration and ED 524, Occupation Information.

INDUSTRIAL AND TECHNICAL EDUCATION

Poe Hall

Professor D. M. Hanson, Coordinator of Advising

Professor Emeritus J. T. Nerden, Assistant Professor F. S. Smith, Assistant Professor W. M. Parker, T. C. Shore Jr.

The Industrial and Technical Education program offers curricula to prepare teachers, supervisors and administrators for the public schools, area vocational schools, community colleges and technical institutes. Complete four-year curricula in vocational industrial education and technical education lead to the Bachelor of Science in education. The curricula are planned to provide students with broad cultural and professional backgrounds to parallel occupational experience.

The program offers graduate degrees (see listing of graduate degrees offered). For further information consult the Graduate Catalog.

VOCATIONAL INDUSTRIAL EDUCATION

The curriculum in vocational industrial education is designed to prepare vocational teachers for the secondary schools, area vocational schools and post-secondary school vocational programs. Upon satisfactory completion of the curriculum the graduate is qualified to teach in any of the aforementioned vocational areas.

OPPORTUNITIES

Graduates of the vocational industrial education curriculum have a wide selection of employment opportunities. The rapid growth of the vocational programs in the secondary schools in all fields has created an urgent demand for vocational teachers. A student may qualify for teaching positions in introduction to industrial education, trade preparatory training and industrial cooperative training in these fast-growing programs in the secondary schools. Other opportunities include teaching in the area vocational schools, in industry and in the post-secondary schools.

VOCATIONAL INDUSTRIAL EDUCATION CURRICULUM

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ED 100 Introduction to Industrial Education	2	History Elective	3
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 111 Algebra & Trigonometry	3-4	MA 122 Math of Finance or Mathematics Elective	3
MA 11a Introduction to Contemporary Mathematics		Drafting Elective	3-4
CH 111 Foundations of Chemistry or Elective	4	Physical Education	1
Physical Education	1	Elective	3
	13-14		16-17
SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Physics Elective	3-4	SOC 202 Principles of Sociology	3
Speech Elective	3	EB 201 Economics I	3
PS 201 The American Governmental System	3	ED 305 Analysis of Technical Education Programs & Course Construction	3
Physical Education	1	ED 327 History & Philosophy of Industrial & Technical Education	3
Electives	6	PE 280 Emergency Medical Care and First Aid	2
	16-17	Physical Education	1
		Elective	3
			18
JUNIOR YEAR			
<i>Fal Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ED 344 School & Society	3	PSY 376 Human Growth and Development	3
IE 456 Introduction to Occupational Safety & Health	3	ED 426 Organization of Related Study Materials in Vocational Education or	
ED 421 Principles & Practices in Industrial Cooperative Training or		ED 405 Industrial and Technical Education Shop & Laboratory Planning	3
ED 40a Industrial & Technical Education Shop & Laboratory Planning	3	ED 440 Vocational Education	2
PSY 304 Educational Psychology	3	ED 422 Methods of Teaching Vocational Industrial Technical Education	3
ED 420 Principles of Guidance	3	ED 483 An Introduction to Instructional Media	3
Elective	3	Elective	3
	18		17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ED 444 Student Teaching in Voc. Ind./Tech. Educ.	8	Economics Elective	3
ED 457 Organization & Management of Youth Club Activities	3	Sociology Elective	3
ED 496 Senior Seminar in Education	3	English Elective	3
	14	Elective	6
			15
		Hours Required for Graduation	12*

*Twelve hours of electives must be selected in accordance with the student's area of specialization and with the approval of the advisor. The remaining hours may be taken as free electives.

TECHNICAL EDUCATION

The curriculum in technical education is oriented toward preparing instructors within a wide range of teaching technologies and is closely coordinated with existing engineering curricula. A student enrolling in the technical education curriculum may specialize to some extent in areas related to interest 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.

OPPORTUNITIES

Employment opportunities for technical education graduates include teaching in the expanding community college complex, technical institutes, area vocational schools and within industry as instructors and coordinators of training programs. The growth of technical education in the nation and the large number of new technical education facilities being constructed will require an increasing number of instructors to staff teaching positions.

TECHNICAL EDUCATION CURRICULUM*

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	4	EB 201 Economics I	3
ED 100 Introduction to Industrial Education	2	ENG 112 Composition and Reading	3
ENG 111 Composition and Rhetoric	3	MA 102 Analytic Geometry and Calculus I	4
MA 111 Algebra and Trigonometry	4	PS 211 The American Governmental System	3
Physical Education	1	Physical Education	1
	14		11

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
E 101 Engineering Graphics I	2	PSY 200 Introduction to Psychology	4
English Elective	3	PY 208 General Physics or	
MA 201 Analytic Geometry & Calculus II	4	PY 212 General Physics	4
PY 205 General Physics or		Electives**	6
PY 211 General Physics	4	Physical Education	1
Physical Education	1		11
	11		

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ED 311 History & Philosophy of Industrial & Technical Education	3	ED 311 Analysis of Technical Education Programs & Course Construction	3
PSY 301 Educational Psychology	4	SOC 215 Work Occupations and Professions	3
SOC 202 Principles of Sociology	4	Electives**	9
Electives**	6		15
	17		

SENIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
ED 405 Industrial & Technical Education Shop and Laboratory Planning	3	ED 444 Student Teaching in Voc. Ind./Tech. Education	8
ED 422 Methods of Teaching Vocational Industrial/Technical Education	3	Electives**	7
Electives**	9		15
	15	Hours Required for Graduation	116

* Students will be expected to demonstrate proficiency in the applied technology of his or her choice—may be fulfilled by technical institute training or selected courses in addition to those required for the degree.

** Minimum of 27 hours of elective courses must be selected from engineering, engineering sciences, physical sciences, etc., in accordance with the student's area of specialization and with the approval of the adviser. Remaining hours may be taken from free electives.

MATHEMATICS AND SCIENCE EDUCATION

Poe Hall

Professor H. E. Speece, Head of the Department and Coordinator of Advising

Professors: N. D. Anderson, L. M. Clark, J. R. Kolb; Associate Professors: R. D. Simpson, W. M. Waters Jr., L. W. Watson; Associate Professor Emeritus: H. A. Shannon; Adjunct Assistant Professors: R. R. Jones, C. M. Meek; Visiting Assistant Professor: E. G. Blakeway

The Department of Mathematics and Science Education offers a program for preparing undergraduate students as teachers of mathematics and science. The programs are designed to 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 needed by teachers entering the schools of today. The depth of preparation will enable students to pursue programs of graduate studies. (See listing of graduate degrees offered and the Graduate Catalog.)

OPPORTUNITIES

The demand for qualified mathematics and science teachers in our schools and colleges provides opportunities for mathematics and science education graduates. Developments in the schools and in our society accentuate the importance of preparation and competence in teaching, and this is reflected in increased salaries, opportunities for graduate study and professional advancement.

MATHEMATICS EDUCATION CURRICULUM

FRESHMAN YEAR

Fall Semester	Credits	Spring Semester	Credits
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
PHI 201 Logic	3	MA 201 Analytic Geom. & Calc. II	4
MA 122 Math of Finance	3	History Elective	3
MA 102 Analytic Geom. & Calc. I	4	Human/Soc. Sci. elective	3
Physical Education	1	Physical Education	1
ED 101 Orientation	0	CSC 111 Algorithmic Lang. I	2
	14	or	
		CSC 101 Intro to Programming	3
		16-17	

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 202 Analytic Geom. & Calc. III	4	Math elective	3
*Science	4	*Science	4
ENG Literature elective	3	ST Elective	3-4
MA 114 Intro. to Finite Math with Applications	3	ED 203 Intro. to Teaching Ma./Sci.	3
†Human/Soc. Sci. elective	3	ED 203L Intro. to Teaching Ma./Sci. Lab.	0
Physical Education	1	Speech elective	3
	18	Physical Education	1
			17-18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ED 101J Orientation	0	ED 101J Orientation	0
MA 403 Intro. to Mod. Alg.	3	MA 408 Found. Euclidean Geom.	3
PSY 304 Educational Psychology	3	ED 344 School & Society	3
ED 451 Improving Reading in Secondary Schools	2	MA 433 History of Mathematics	3
**Supporting elective	3	**Supporting elective	3
†Human/Soc. Sci. elective	3	†Human/Soc. Sci. elective	3
Elective	3	PSY 476 Psych. of Adoles. Dev.	3
	17		18

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
†ED 495 Sr. Seminar in Ma./Sci. Ed.	2	**Supporting elective	3
†ED 470 Methods of Teach. Math	3	MA 405 Introd. to Linear Algebra and Matrices	3
†ED 471 Stud. Teach. in Math	8	†Human/Soc. Sci. elective	3
†ED 472 Dev. & Sel. Tea. Mat. Ma.	2	Elective	3
	15	Elective	3
			15

Hours Required for Graduation130

* Science must be 2-semester sequence in chemistry or physics.

** Supporting electives must be an approved sequence in science, math, computer science, statistics, economics, philosophy, history of science, sociology, psychology.

† The humanities/social sciences electives must be chosen so that 5 hours are in humanities and 9 hours are in the social sciences. Humanities include: philosophy, religion, literature, fine arts, history, or foreign languages. Social sciences include: economics, sociology, anthropology, political science, psychology and geography.

†† These courses are taken as a block in the professional semester.

SCIENCE EDUCATION CURRICULUM

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
MA 102 Analytic Geom. & Calc. I	4	MA 201 Analytic Geom. & Calc. II	4
or		or	
MA 112 Analytic Geom. & Calc. A	4	MA 212 Analytic Geom. & Calc. B	3
CH 101 Gen. Chemistry I	4	CH 103 Gen. Chemistry II	4
Humanities/Soc. Sciences*	3	or	
Physical Education	1	CH 107 Prin. Chem.	4
ED 101 Orientation	0	Biological Sci. elective	4
	15	Physical Education	1
			15-16

SOPHOMORE YEAR

Full Semester	Credits	Spring Semester	Credits
PY 211 General Physics	4	PY 212 General Physics	4
Speech elective	3	ED 203 Intro Teaching Math /Sci	3
Required science	3	ED 203L Intro. Teach. Math /Sci. Lab	0
Elective	3	Humanities Soc Sci	3
Physical Education	1	Physical Education	1
Humanities Soc Sci	3	Required science*	6
	17		17

JUNIOR YEAR

Full Semester	Credits	Spring Semester	Credits
PSY 304 Educational Psychology	3	ED 344 School and Society	3
Humanities Soc. Sci	3	Humanities/Soc Sci	3
Required science*	7	Required science*	6
HI 321 Ancient & Med Science	3	PSY 476 Psych Adol. Development	3
or		ED 451 Improving Reading in Secondary Schools	2
HI 322 Rise of Modern Science	3		17
or			
PHI 340 Philosophy of Science	3		
	16		

SENIOR YEAR

Full Semester	Credits	Spring Semester	Credits
ED 475 Methods of Teach. Sel.	3	Humanities/Social Sci	6
ED 476 Student Teaching in Sci.	8	Electives	6
ED 477 Instructional Materials In Science	2	Required science*	5
ED 495 Sr. Sem in Math /Sci Ed.	2		17
	15		

Hours Required for Graduation129

Required of those specializing in Chemistry or Physics.

To be selected as follows from the Humanities and Social Sciences:

One course in history 3 s.h.

One course in literature 3 s.h.

Two additional courses from any of the following humanities.

Fine Arts, Foreign Language, History, Literature, Philosophy, Religion 6 s.h.

Three courses from any of the following social sciences:

Anthropology, Economics, Geography, Political Science, Sociology, Psychology 9 s.h.

* Students may elect to take PY 205 and PY 208 or PY 201, 202, and 203 in lieu of PY 211-212.

Students are required to take a minimum of 27 semester hours in one of four areas of specialization (biology, chemistry, physics, or earth science).

These courses are taken as a block in the professional semester (offered only during the fall semester for Science Education students).

SCIENCE EDUCATION SPECIALIZATION REQUIREMENTS (27 hours)

BIOLOGY SPECIALIZATION:

Survey of Plant Life (BO 200)	4
Survey of Animal Life (ZO 201)	4
Introductory Organic Chemistry (CH 220)	4
Genetics (GN 301 or GN 411, 412)	3-4
Ecology (BO/ZO 360)	4

General Microbiology (MB 401)	4
Plant Physiology (BO 421)	

or

Vertebrate Physiology (ZO 421)	3-4
Cell Biology (ZO/BO 414)	

CHEMISTRY SPECIALIZATION:

Organic Chemistry	4
Analytic Chemistry	4
Physical Chemistry	4

MA 202 Analytic Geometry & Calculus III	4
Earth Science Elective	3
Chemistry Electives	8

EARTH SCIENCE SPECIALIZATION:

GY 101 General Physical Geology	
GY 110 Physical Geology Laboratory	4
GY 201 Historical Geology	
GY 210 Historical Geol. Lab	4
MY 201 Atmospheric Environment	
or	
MY 311 Physical Climatology	3
PY 223 Astronomy	3
MSE 200 Introduction to the Marine Environments	3

Earth Science Electives	10	PY 203 General Physics	34
PHYSICS SPECIALIZATION		MA 202 Analytic Geometry & Calculus III	4
PY 223 Astronomy	3	Earth Science Elective	3
PY 407 Introduction to Modern Physics or		Physics Mathematics Electives	13 14

OCCUPATIONAL EDUCATION

Associate Professor J. R. Clary, Head of the Department and Coordinator of Advising

Professors: J. K. Coster, D. M. Hanson, Professors Emeriti: I. Huettel, J. B. Kirkland, J. T. Norden, D. W. Olson C. C. Scarborough; Assistant Professors: C. D. Bryant, T. R. Miller, P. S. Smith, R. E. Weng, T. B. Young, Assistant Professors: W. L. Cox Jr., L. R. Jewell, R. L. Nuney, W. M. Parker, T. C. Shore Jr., R. T. Traxler, Adjunct Assistant Professor: W. R. Robinson

Occupational education involves a study of the occupational structure of society, manpower requirements, and the functions of vocational education. There is no undergraduate program in occupational education. However, undergraduate courses are offered which support vocational education programs. The Department of Occupational Education offers programs which lead to graduate degrees (see listing of graduate degrees offered). For further information consult the Graduate Catalog.

PSYCHOLOGY

Poe Hall

Professor P. W. Thayer, Head of the Department and Coordinator of Advising

Professors: H. M. Carter, J. W. Cunningham, D. W. Drewes, T. E. LeVere, H. G. Miller, S. E. Newman, R. G. Pearson, B. W. Westbrook; Professors Emeriti: K. L. Barkley, J. C. Johnson, Adjunct Professor: R. W. Oppenheim, Assistant Professor: J. L. Cole, J. E. R. Loginbuhl, D. H. Mershon, M. H. Pitts, R. F. Rawls, F. J. Smith, J. L. Wasik; Associate Professor Emeritus: J. W. Magill, Adjunct Associate Professors: B. C. Ball, B. F. Corder, J. L. Howard, B. A. Norton, M. N. Wiebe, Assistant Professors: D. L. Chmielewski, V. G. Cowgell, P. D. Green, J. W. Kalat, K. W. Klein, L. A. Makoid, L. S. Taylor, Adjunct Assistant Professors: P. A. Gabe, J. L. Howard, C. L. Kronberg, L. D. Sieber, C. J. Theison Jr.

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.

The Department of Psychology also offers graduate programs (see listing of graduate degrees offered). For further information see the Graduate Catalog.

OPPORTUNITIES

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 clinical 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.

UNDERGRADUATE PROGRAMS

There are currently three different programs for undergraduate majors in psychology: the General Option (PSY), the Human Resource Development Option (HRD), and the Experimental Option (PEO). Each of these programs emphasizes different aspects of the study of psychology. The following sections provide separate descriptions of these three programs and their current requirements.

PSYCHOLOGY: GENERAL OPTION

The General Option is suitable for those students who wish to study psychology, in order to learn principles of human behavior which they can apply to other fields of endeavor. This

program 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 graduate 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.

Unless a student requests admission to the Experimental Option or the Human Resource Development Option, he/she is considered to be in the General Option.

REQUIREMENTS

I. Major Area Courses		
PSY 200 Introduction to Psychology	3	
PSY 300 Perception	3	
PSY 310 Learning and Motivation	3	
PSY 320 Cognitive Processes	3	
PSY 412 Psychological Research Applied to Current Problems or PSY 210 Psych. Analysis Applied to Current Problems	3	
PSY 491 Research Methods in Psychology	3	
PSY 492 Seminar in Psychology	3	
Psychology Electives (any two additional PSY courses)	6	
		27
II. Mathematics and Science Courses		
Mathematics (two courses)		6-8
ST 311 Introduction to Statistics	3	
BS 100 General Biology (4) or BS 105 Biology in the Modern World (4)	4	
Natural Science (two courses)		6-8
		19-23
III. Humanities and Social Sciences		
English Composition (ENG 111 and 112)*	6	
Literature (two courses)	6	
History (two courses)*	6	
Philosophy (two courses)	6	
Sociology*	3	
Social Science (three courses)*	9	
		36
IV. Physical Education		4
V. Electives		
Advised Electives		24-27
Free Electives		12
		36-39
Hours Required for Graduation		124

See Notes on Requirements that apply to all options in Psychology.

General Option Curriculum Display

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Mathematics	3-4	Mathematics	3-4
English 111	3	English 112	3
Biological Science	3-4	PSY 200 Intro. to Psych.	3
History	3	History	3
Social Science	3	Elective	3
PE	1	PE	1
	16-18		16-17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Psychology Elective or PSY 210 Psy An App Cur Proh.)	3	PSY 300 Perception	3
Natural Science	3-4	Natural Science	3-4
Literature	3	Elective	3
Sociology	3	Statistics	3
Elective (Advised)	3	Literature	3
PE	1	PE	1
	16-17		16-17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PSY 310 Learning	3	PSY 320 Cognition	3
Philosophy	3	PSY 491 Res. Meth. in Psy.	3
Psychology Elective	3	Social Science	3
Elective (Advised)	3	Elective (Advised)	3
Elective	3	Elective (Advised)	3
	15		15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PSY 492 Seminar	3	PSY 412 Psy Res. App. Cur. Proh for Psychology Elective	3
Philosophy	3	Elective (Advised)	3
Social Science	3	Elective (Advised)	3
Elective (Advised)	3	Elective (Advised)	3
Elective (Advised)	3	Elective	3
	15		15

Minimum hours required for graduation 124

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, counselling, 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 full-time in a job related to his/her own area of interest.

The HRD Option accepts 20 students each year. Interested students can apply for admission to HRD during their sophomore or junior year. Further information and application forms are available in the Psychology Department Office.

REQUIREMENTS

I. Major Area Courses			
PSY 200	Introduction to Psychology		3
PSY 350	Interviewing and Behavior Observation Skills		4
PSY 351	Instructional Skills		1
PSY 352	Organizational Skills		4
PSY 491	Research Methods in Psychology		3
PSY 492	Seminar in Psychology		3
PSY 493	Special Topics in Psychology		4
PSY 495	Human Resource Development Practicum		8
			33
II. Mathematics and Science Courses			
Mathematics (two courses)			
ST 311	Introduction to Statistics		3

BS 100 General Biology (4)	4
or BS 105 Biology in the Modern World (4)	4
Natural Science (two courses)	6-8
	19-23
III Humanities and Social Sciences	
English Composition (ENG 111 and 112) ^a	6
Literature (two courses)	6
History (two courses) ^b	6
Philosophy (two courses)	6
Sociology ^c	3
Social Science (three courses) ^d	3
SP 110 Public Speaking	3
	39
IV. Physical Education	4
V Electives	
Advised Electives	15-18
Free Electives	12
	27-30
Hours Required for Graduation	125

See Notes on Requirements that apply to all Psychology options.

Human Resource Development Option Curriculum Display

FRESHMAN YEAR		SOPHOMORE YEAR	
	<i>Cr. Hrs.</i>		<i>Cr. Hrs.</i>
PSY 200 Introduction to Psychology	3	Natural Science (two courses)	6-8
Mathematics (two courses)	6	Statistics (one course)	3
ENG 111, 112 Composition (two courses)	6	Social Science (three courses)	9
History (two courses)	6	Philosophy (one course)	3
Sociology (one course)	3	English Literature (two courses)	6
Biology (one course)	4	Elective (one course)	3
Elective (one course)	3	Physical Education	2
Physical Education	2		32-34
	33		
JUNIOR YEAR			
<i>Full Semester</i>	<i>Cr. Hrs.</i>	<i>Spring Semester</i>	<i>Cr. Hrs.</i>
SP 110 Public Speaking	3	PSY 493 Special Topics in Psychology	4
PSY 350 Interviewing & Behavior Observation Skills	4	PSY 495 Human Resource Development Practicum	5
PSY 351 Instructional Skills	4		12
PSY 352 Organizational Skills	4		
	15		
SENIOR YEAR			
	<i>Cr. Hrs.</i>		
PSY 491 Research Methods in Psychology	3	Philosophy (one course)	3
PSY 492 Seminar in Psychology	3	Electives (eight courses)	24
	3		38
		Minimum hours required for graduation	125

PSYCHOLOGY: EXPERIMENTAL OPTION

Experimental psychology is concerned with the systematic analysis of the behavior of organisms, and is traditionally subdivided into the areas of learning, motivation, cognition, perception, neuropsychology, personality, and social interaction. The experimental psychologist typically studies behavior in a closely-controlled laboratory setting, in order to understand precisely how an organism responds in specific environments.

The Experimental Option curriculum provides a background in psychological principles and scientific methods which prepares students for graduate or professional study in any of the behavioral sciences. This option involves course work in the fundamental areas of ex-

perimental psychology, and extensive training in the design and conduct of laboratory research. The program also requires study in mathematics and in other sciences, including courses in calculus, statistics, computer science, biology, genetics, and the physical sciences.

REQUIREMENTS

I. Major Area Courses:		
PSY 200	Introduction to Psychology	3
PSY 300	Perception	3
PSY 310	Learning and Motivation	3
PSY 320	Cognitive Processes	3
PSY 400	Perception: Research Methods	3
PSY 410	Learning and Motivation: Research Methods	3
PSY 420	Cognitive Processes: Research Methods	3
PSY 430	Neuropsychology: Research Methods	3
PSY 506	History and Systems of Psychology	3
		27
II. Mathematics and Science Courses:		
MA 112	Analytic Geometry and Calculus A (4)	
or MA 102	Analytic Geometry and Calculus I (4)	4
MA 212	Analytic Geometry and Calculus B (3)	
or MA 201	Analytic Geometry and Calculus II (4)	3
MA 114	Intro. to Finite Math. with Applications	3
ST 311	Introduction to Statistics	3
CSC 101	Introduction to Programming (3)	
or CSC 111	Introduction to Fortran Programming (2)	
or CSC 482	Computing for the Social Sciences (3)	2-3
BS 100	General Biology (4)	
or BS 105	Biology in the Modern World (4)	4
GN 411	The Principles of Genetics	3
	Chemistry or Physics (a two-semester sequence in either) ¹	8
		30-31
III. Humanities and Social Sciences:		
	English Composition (ENG 111 and 112) ²	6
	Literature (two courses)	6
	History (two courses) ³	6
	Logic and Philosophy of Science (any two courses)	6
	Philosophy (one advised elective in addition to above)	3
	Social Science (two courses) ⁴	6
		33
IV. Physical Education¹		4
V. Electives¹¹		
	Advised Electives	18
	Free Electives	12
		30
	Hours required for Graduation	124

See Notes on Requirements that apply to all Psychology options.

Experimental Option Curriculum Display

FRESHMAN YEAR			
Fall Semester	Credits	Spring Semester	Credits
MA 112 Anal Geom Calc A		MA 212 Anal Geom Calc B	
or MA 102 Anal Geom Calc I	4	or MA 201 Anal Geom Calc II	3 4
BS 100 General Biology		PSY 200 Intro to Psych	3
or BS 105 Bio Mod World	4	ENG 112 Comp and Reading	3
ENG 111 Comp and Rhetoric	3	PHI Logic or Philosophy of	
Elective	3	Science	3
Physical Education	1	Elective	3
	15	Physical Education	1
			16-17

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 114 Topics Modern Math	3	Social Science	3
Literature	3	Literature	3
History	3	History	3
PSY 300 Perception	3	PHI Logic or Philosophy of Science	3
Physical Science I	4	Physical Science II	4
Physical Education	1	Physical Education	1
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PSY 310 Learning and Motiv	3	PSY 320 Cognitive Processes	3
PSY 400 Perception: Res Meth	3	PSY 410 Learn and Motiv: Res Meth	3
GN 411 Prime Genetics	3	Elective (Advised)	3
ST 311 Intro to Stat	3	Computer Science	3
Elective	3	Elective	3
	15		14 15

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PSY 420 Cognit Proc: Res Meth	3	PSY 430 Neuropsy: Res Meth	3
Philosophy elective	3	PSY 505 Hist & Syst of Psych	3
Social Science	3	Elective (Advised)	3
Elective (Advised)	3	Elective (Advised)	3
Elective	3	Elective	3
	15		15

Minimum hours required for
graduation124

PSY 210 and 412 cover related topics in current social problems. If possible, psychology majors should take PSY 412 during their junior or senior year; PSY 210 will, however, satisfy this requirement. If both courses are taken, both will count toward graduation (one as a requirement, the other as an elective).

Any two courses in the Mathematics Department, except that a) double credit for comparable courses will not be allowed, in accordance with Mathematics Department decisions (see course listings in catalog), b) MA 111 can not be used toward the mathematics requirement although MA 111 may count as an elective, and c) no credit toward graduation will be allowed for MA 115 if taken after Fall 1977.

Courses intended to satisfy the Natural Science requirement must be selected from the Biological Sciences, including such disciplines as Biology, Botany, Genetics, and Zoology, and from the Physical Sciences, including such disciplines as Chemistry, Geology, Meteorology, and Physics. At least one of the two Natural Science courses must include a laboratory or be taken with an optional laboratory course. Courses in primarily technological or applied areas such as Animal Science, Crop Science, Food Science, Forestry, Computer Science, Horticultural Science, Nutrition, Engineering, Military Science, Poultry Science, Soil Science, Textiles, Wood and Paper Science, Veterinary Science, etc., may not be used to satisfy the Natural Science requirement, although they may be used as free electives.

Students who pass ENG 112H with a grade of C or better automatically receive credit for ENG 111.

The Literature requirement may be satisfied by any of the courses listed as "Literature" by the English Department. Composition and Writing courses cannot be used to satisfy this requirement. Foreign language literature courses at the 300-level or above can be used toward this requirement.

Any two courses in the History Department.

Any two PHI courses in the Philosophy Department (at least one course in logic or the philosophy of science is highly recommended).

SOC 202 Principles of Sociology is highly recommended.

Courses intended to satisfy the Social Science requirement should be chosen from at least two (and preferably three) of the following areas:

- a) Sociology
- b) Anthropology
- c) Political Science
- d) Social Work (SW 203)
- e) Economics (any EB courses except those in business law: EB 307, EB 308)
- f) Psychology: no more than one non required psychology course may count toward the Social Science requirement

A total of 4 hours credit in physical education is normally required, unless a student obtains a waiver of the physical education requirement from the office of the Dean of Education. In such cases, the number of hours associated with the waived courses will also be waived (i.e., no other courses need be taken in place of PE).

Twelve hours of these Electives are Free Electives; all remaining Elective courses are to be considered Advised Electives and each student should consult with his/her advisor prior to selecting such courses. Students are encouraged to investigate other areas of study and to take advantage of the inter disciplinary offerings of the UNI program. All such courses may be credited toward the elective requirement. Students are expected to confer with their advisors whenever possible, in order to make best use of these elective choices. Students considering application to graduate school in psy-



Scores of well-equipped laboratories on the campus contribute to providing superior education in the sciences, technologies and other fields.

chology are especially urged to confer with their advisors 1) concerning the advisability of taking additional courses in psychology or other specific areas, and 2) the scheduling of courses in such a way that preparation for the Graduate Record Examinations will be optimized.

¹¹The two required courses in physical science in the Experimental Option must be *in sequence* (i.e., a two-semester set of related courses in the same content area).

SCHOOL OF ENGINEERING

Riddick Laboratories

L. K. Monteith, *Dean*

J. F. Ely, *Associate Dean for Academic Affairs*

H. B. Smith, *Associate Dean for Research and Graduate Studies*

J. R. Hart, *Assistant Dean for Extension*

Young men and women who seek a challenging career in research and development, design, construction and production, maintenance, technical sales, management, teaching, or other careers requiring a methodical, creative solution of problems, should consider an engineering education. At NCSU, the School 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 young men and women to become the leaders and prime movers of our increasingly technological world. Because of the great impact of science and technology on our everyday lives, today's engineer is more acutely aware of and responsible for the impact and cost that his creations may have on society. In addition to safety, esthetics, economics, and energy, today's engineer must consider environmental, sociological, and other "human concern costs."

The School's 20,000 graduates may be found in widely diversified careers throughout the world. Most are, of course, practicing in the engineering profession, but because their engineering education has equipped them well to deal with a problem in a wide variety of fields, many engineering graduates have chosen to become corporate presidents, leaders in government, lawyers, and medical doctors, to name a few.

The School of Engineering is organized into eight departments: Biological and Agricultural, Chemical, Civil, Electrical, Industrial, Materials, Mechanical and Aerospace, and Nuclear. Eleven undergraduate degree programs are offered in the eight departments. In addition, a degree in engineering operations is offered through an interdepartmental arrangement. Most teaching departments offer advanced studies leading to the professional degree, master's degrees and the Doctor of Philosophy degree. See listing of graduate degrees offered.

The School of Engineering requested the Engineers' Council for Professional Development (ECPD) to review ten of its undergraduate programs. In 1974, the ECPD found that all ten curricula more than met its accreditation standards and accreditation has continued. All curricula and programs are designed to meet 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 engineering knowledge.

A Career Planning and Placement Office is maintained by the University to assist continuing students, graduating students and alumni.

UNDERGRADUATE CURRICULA AND DEGREES

The first-year engineering curriculum is common to all twelve undergraduate degree programs. Entering students are assigned to the Freshman Engineering and Student Services Division which advises each student in planning an appropriate program of study. Although some entering students indicate a curriculum choice, it is not necessary to make a choice of curriculum until the end of the first year, when one is in a better position to judge which of the twelve branches of study in engineering is most suited to one's own interests and talents.

Bachelor of Science—The four-year program provides preparation for entry into graduate school, industry, government, business or private practice. Graduates with a BS in engineering may be engaged in design, development, production, sales, maintenance, or the planning and operation of industrial units.

The four-year curricula offer programs of study leading to a bachelor's degree in aerospace engineering, biological and agricultural engineering, chemical engineering, civil engineering, civil engineering construction option, electrical engineering, engineering operations, fur-

niture manufacturing and management, industrial engineering, materials engineering, mechanical engineering, and nuclear engineering.* Graduation requirements include the satisfactory completion of the specified number of credit hours of required courses and electives in any one of the twelve curricula. The total number of required hours ranges from 129 to 133 semester hours.

Double Degree Programs—Students may wish to earn a bachelor of science degree in two fields of engineering. When the two courses of study are planned sufficiently early to optimize the student's time, it is often found that courses required in one field may be substituted for required courses in the other field. The humanities-social science, physics, mathematics, chemistry, English and physical education sequences are common to both fields. Also required courses in one field can be used as free electives in the other field. This type of double degree program can usually be completed in five years or less. Students interested in such a program should consult the Associate Dean, Academic Affairs, or the Director, Freshman Engineering and Student Services Division, and the Department Heads of the two fields.

Other students may wish to combine a bachelor of science in engineering with a bachelor of science or bachelor of arts degree in some other school at North Carolina State University. As in the double engineering degree program, it is often found that courses required in one school may be substituted for courses required in the other school. When the two academic programs are planned sufficiently early to optimize the student's time, this type of double degree program can usually be completed in five years. Students interested in this double degree program should contact the Associate Dean, Academic Affairs, or the Director, Freshman Engineering and Student Services Division, and the Dean of the school offering the other degree.

Special transfer programs have been approved with other two- and four-year colleges and universities. These allow a student to complete two or three years at another institution, transfer to the School of Engineering at NCSU, complete the engineering degree requirements in an additional two or three years, and then receive a degree from each of the institutions. For additional information, contact the Associate Dean for Academic Affairs, School of Engineering.

The School of Engineering has been particularly active in the inter-institutional agreements between North Carolina State University and the Cooperating Raleigh Colleges (CRC). Contact the Freshman Engineering and Student Services Division for additional information.

Professional Degree in Engineering—The School of Engineering offers professional curricula leading to the degrees 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 four-year undergraduate curricula. For further details, see "PROFESSIONAL DEGREE."

HONORS PROGRAM

The Engineering Honors Program provides enriched educations for academically talented juniors and seniors. The opportunities which distinguish this program from standard programs of study are: 1) considerable flexibility in designing individual programs, 2) special courses for honors students, 3) special seminars, 4) individual study or research with a personally chosen professor. Each department has an honors adviser who can provide further information.

COOPERATIVE EDUCATION PROGRAM

A program of cooperative education began in 1968-69 in the Engineering School. The optional program is planned such that the student may alternate semesters of study with semesters of work during the sophomore and junior academic levels. The freshman and

* Engineering Science and Mechanics—Students enrolled in Engineering Science and Mechanics prior to July 1, 1976, should consult the 1975-77 Undergraduate Catalog for the curriculum requirements for a bachelor's degree in Engineering Science and Mechanics.

senior years are spent on campus while the sophomore and junior academic levels are spread over a three-year period to permit the interfacing of the academic semesters with practical work experience semesters. The co-op plan requires five years for completion during which time the student receives approximately 18 months of practical experience.

Students in all curricula in Engineering may participate if they have a grade-point average of 2.25 or better. After a student is accepted, he or she is expected to maintain at least a 2.00 grade-point average. Application for admission into the co-op program should be made early in the Fall semester of the freshman year or 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. Further information may be obtained from the Director of Cooperative Engineering Education, 236 Riddick Building.

STUDENT ACTIVITIES

Each curriculum in the School 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 department also has one or more honor societies to give recognition to those with superior academic records. In addition to the departmental technical societies, school-wide honor, professional, and service societies offer personally and educationally rewarding opportunities for students. Student representatives of the technical societies serve on the Engineers' Council, the coordinating agency for students' needs and school-wide activities such as Open House, the Engineers' Week Exhibition, and the annual St. Patrick's Day Dance.

HUMANITIES AND SOCIAL SCIENCES

Each student is required to take a minimum of 18 hours of Humanities-Social Science courses. Of these 18, 12 are in required areas as designated below.

1. The beginning economics course, EB 201.
2. A beginning course in literature. It is suggested that this be one of the 200-level literature courses listed.
3. A beginning course in history. It is suggested that this be one of the 200-level history courses listed.
4. A course in the history or philosophy of science. Suggested courses are:

HI 321	Ancient and Medieval Science
HI 322	Rise of Modern Science
HI 341	Technology in History
PHI 340	Philosophy of Science
UNI 301	Science and Civilization
UNI 302	Contemporary Science and Human Values

The other 6 hours of the minimum 18 hour requirement may be fulfilled by taking any two of the courses from the list of Humanities and Social Science courses for the School of Engineering. An updated version of the list is made available each semester prior to pre-registration and can be obtained from the student's adviser or department. Students should contact their adviser or department for an updated list of humanities and social science courses.

FRESHMAN ENGINEERING AND STUDENT SERVICES DIVISION

Associate Professor R. H. Hammond, Director and Coordinator of Advising

Assistant Professors: R. J. Leuba, W. J. Vander Wall; Senior Advisers: G. K. Hilliard Jr., B. Houch Jr.; Instructors: G. A. Finley, J. F. Freeman, J. P. Newby, B. D. Webb; Lecturer: J. L. Crow

All students in their first year in the School of Engineering are required to take the same general program of courses. The Freshman Engineering and Student Services Division ad-

vises all freshman students on academic affairs and arranges a program of courses which best suits one's individual background and talents and permits one the greatest probability of academic success. This division also offers general counseling service to all engineering students.

Although an entering student may designate the curriculum he or she proposes for a major, it is not necessary to decide upon a major until the end of the freshman year. As each student earns 28 or more credits, they are transferred to the department of his or her choice. This normally is achieved at the end of the spring semester.

The Freshman Engineering and Student Services Division offers assistance to high schools on questions involving engineering as a career. However, its major function is guiding and counseling each freshman engineering student.

TYPICAL FRESHMAN YEAR IN ALL ENGINEERING CURRICULA

	<i>Credits</i>
CH 101 General Chemistry I	4
CH 105 Chemistry Principles and Applications*	3
E 101 Engineering Graphics I	2
E 120 Engineering Concepts	3
ENG 111 Composition and Rhetoric	3
ENG 112 Composition and Reading**	3
Humanities Social Science***	3
MA 102 Analytic Geometry and Calculus I	4
MA 201 Analytic Geometry and Calculus II	4
PY 205 General Physics	4
Physical Education	2
	35

The program above is typical. Other courses may be substituted, added, or deleted, dependent upon each student's individual background and talents. Individual programs might range from 28 to 35 credits.

* Those students who intend to major in chemical engineering or who expect to take additional chemistry courses will take CH 107, Principles of Chemistry, instead of CH 105

** Qualified students will be offered an advanced placement course, ENG 112H. If a grade of "C" or better is achieved, credit is also given for ENG 111. Qualified students will be notified by the Registrar and during freshman orientation. Other students will be required to take the ENG 111, 112 sequence

*** The humanities or social science courses usually suggested are HI 205, Western Civilization Since 1400, or EB 201, Economic Activity. Students who are advised to carry less than 35-hour load during their freshman year can delay taking the H & SS electives until a subsequent semester.

BIOLOGICAL AND AGRICULTURAL ENGINEERING

(Also see Agriculture and Life Sciences.)

David S. Weaver Laboratories

Professor F. J. Hassler, Head of the Department

Professor G. B. Blum Jr., Coordinator of Advising

(For a list of faculty, see Agriculture and Life Science.)

Students in biological and agricultural engineering train to deal with problems of agriculture that are engineering in nature. Scientific and engineering principles are applied to the conservation and utilization of water and soil, the development of power and labor-saving devices for all phases of agricultural production, the design of structures and equipment for housing and handling livestock and field products, and the processing and marketing of farm products.

OPPORTUNITIES

Biological and agricultural engineers are qualified for positions in design, development and research in public institutions and in industry, and for teaching and extension work in institutions of higher education. The curriculum provides adequate training for postgraduate work leading to advanced degrees (see listing of advanced degrees offered). Graduates receive the degree of Bachelor of Science in biological and agricultural engineering.

UNDERGRADUATE CURRICULUM

The science curriculum in biological and agricultural engineering develops young people capable of engineering leadership in agriculture. Emphasis is placed on basic science courses such as mathematics, physics, mechanics, biology, soils, and thermodynamics, which provide a sound background for engineering and agricultural technology. Courses in biological and agricultural engineering are directed to those methods of thought and techniques whereby science can be applied with understanding and judgment to engineering situations related to agricultural operations.

Since training in biological and agricultural engineering involves two distinct technical fields agriculture and engineering the science curriculum is a joint responsibility of the two schools and is so administered. Undergraduate students may officially enroll in either school; duplicate undergraduate records are maintained.

BIOLOGICAL AND AGRICULTURAL ENGINEERING CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 202 Analytic Geometry and Calculus III	4	MA 301 Applied Differential Equations I	3
PY 208 General Physics	4	MAE 314 Solid Mechanics	3
MAE 206 Engineering Statics	3	EE 331 Principles of Electrical Engineering	3
BAE 2s1 Elements of Biological & Agricultural Engineering	3	SSC 300 Soil Science	4
CSC 111 Intro. to Fortran Programming	2	Social Sciences & Humanities Elective	3
Physical Education	1	Physical Education	1
	17		17

JUNIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 2 8 Engineering Dynamics	3	BAE 342 Agricultural Processing	4
MAE 391 Electrotechnology in Biological & Agricultural Engineering	3	MAE 462 Functional Design of Field Machines	3
MAE 361 Analytical Methods	3	BAE 391 Agricultural Structures & Environment	3
MAE 311 Engineering Thermodynamics I	3	Social Sciences & Humanities Elective	3
BS 1 0 General Biology	4	Free Elective	3
	16		16

SENIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BAE 451 Agricultural Engineering Design I	3	BAE 452 Agricultural Engineering Design II	3
BAE (SSC) 471 Agricultural Water Management	4	Advanced Technical Elective	3
Social Science & Humanities Elective	6	Free Elective	3
Free Elective	3	Social Science & Humanities Electives	6
	16		15
		Hours Required for Graduation	132

Social Science and Humanities Electives will be selected from the listing of the school in which the student is officially enrolled

The curriculum above is for the science program in biological and agricultural engineering. For the technology curriculum, see Agriculture and Life Sciences.

CHEMICAL ENGINEERING

Riddick Hall

Professor J. K. Ferrell, Head of the Department

Professor J. F. Seely, Coordinator of Advising

Professors: K. O. Beatty Jr., R. M. Felder, R. P. Gardner, H. B. Hopfenberg, D. C. Martin, E. P. Stabel, V. T. Stannett; Professors Emeriti: R. Bright, W. L. McCabe, E. M. Schoenborn Jr.; Adjunct Professors: A. R. Berens, J. C. Bresse, D. M. Preiss, D. R. Squire; Associate Professors: D. B. Maraland, M. R. Overcash, R. W. Rousseau; Adjunct Associate Professors: T. R. Hauser, J. L. Williams; Assistant Professors: P. S. Fedkin, J. E. Heit, W. J. Koros

Chemical engineering is concerned with the design, optimization and control of processes, equipment and plants in which chemical and physical transformations of matter are carried out. Typical industries relying upon chemical engineering include those producing chemicals, polymers, synthetic fibers, metals, drugs, glass, food, gasoline, rocket fuels, paper, soap and cement; those producing energy from nuclear fuels; and those processing materials by methods involving chemical reactions.

Real progress in pollution abatement and control must come through the application of chemical engineering techniques. Chemical engineers are qualified to pursue careers in industries such as these in addition to traditional jobs. Biomedical engineering, pollution abatement and control, and engineering for the nation's energy requirements are other areas.

FACILITIES

Chemical engineering laboratories include pilot plant-type equipment for studying the principles of fluid flow, heat transfer, distillation, absorption, drying, crushing and grinding, filtration, chemical reaction kinetics, etc. Emphasis is placed on the use of both digital and analog computers in the solution of typical chemical engineering problems. Special equipment for research and instructional purposes is designed and built in the departmental laboratories.

OPPORTUNITIES

Graduates find employment in research and development; production, operation and maintenance; management and administration; inspection, testing and process control; technical service and sales; estimation and specification writing; consulting and teaching, and many others. Students desiring to pursue careers in research and development or in teaching and consulting work are advised to consider graduate training (see listing of graduate degrees offered).

CURRICULUM

The chemical engineer's work is so diversified that one's education must be broad and basic. The spirit of research and experimentation is vital, so students need to acquire sound scientific backgrounds essential to original thought and independent accomplishment. The undergraduate curriculum emphasizes the engineering, chemical and economic principles involved in chemical processes and operations. The work in chemistry including inorganic, analytical, physical and organic chemistry is comparable to that usually given to chemists with the exception of a reduction of time devoted to laboratory work. Mathematics and science are also stressed.

CHEMICAL ENGINEERING CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR

Full Semester	Credits	Spring Semester	Credits
CH 221 Organic Chemistry I	4	EE 331 Principles of Elec Engr	3
MA 202 Analytic Geometry & Calculus III	4	Humanities & Soc. Sciences	3
PY 208 General Physics	4	CH 223 Organic Chemistry II	4
CHE 205 Chemical Process Principles	4	CHE 225 Chemical Process Systems	4
Physical Education	1	MA 301 Appl. Differential Eq I	3
	17	Physical Education	1
			18

JUNIOR YEAR

Full Semester	Credits	Spring Semester	Credits
CHE 330 Chemical Engr. Lab I	2	CH 495 Special Topics in Physical Chemistry	3
CHE 315 Chemical Process Thermodynamics	3	CHE 327 Separation Processes I	3
CHE 311 Transport Processes I	3	CHE 331 Chemical Engr. Lab II	2
EB Humanities & Soc. Sciences	3	Humanities & Soc. Sciences	3
MAT 201 Structure & Properties of Engr. Materials	3	CHE 316 Thermodynamics of Chemical & Phase Equilibria	3
Free Elective	3		14
	17		

SENIOR YEAR

Full Semester	Credits	Spring Semester	Credits
Free Elective	3	CHE 451 Chemical Engr Design	3
CHE 432 Chemical Engr. Lab III	2	Approved Chem. Engr. Elective	3
CHE 495 Seminar in Chem Engineering	1	Humanities & Soc. Sciences	3
CHE 446 Chemical Process Kinetics	3	CH 315 Quantitative Analysis	4
CHE 425 Process Measurement & Control	3	Free Elective	3
Humanities & Soc Sciences	3		16
	15	Hours Required for Graduation	133

CIVIL ENGINEERING

Mann Hall

Professor P. Z. Zia, Acting Head of the Department and Coordinator of Advising

Professors: M. Ameen, W. P. Babeock, P. D. Cribbins, R. A. Douglas, J. F. Ely, W. S. Galler, N. S. Grigg, K. S. Havner, C. L. Heimbach, J. W. Horn, A. I. Kashef, P. H. McDonald, W. G. Mullen, C. Smallwood Jr., C. C. Tung, M. E. Uyanik, H. E. Wahls, *Professors Emeritus:* C. R. Bramer, R. E. Fadum; *Associate Professors:* W. L. Bingham, G. H. Blessie, E. D. Gurley, Y. Horie, H. R. Malcom Jr., J. F. Mirza, S. W. Nunnally, J. C. Smith; *Adjunct Associate Professor:* T. R. Hauser; *Associate Professor Emeritus:* G. R. Taylor; *Assistant Professors:* B. D. Barnes, A. C. Chao, J. L. Hulseay, D. W. Johnston, V. C. Matzen, G. N. Richardson; *Adjunct Assistant Professor:* M. T. Mettrey, *Extension Specialist:* R. F. DeBruhl

Civil engineering is one of the broadest of the various fields of engineering. It is a discipline traditionally concerned with the improvement and control of environment and dealing with the planning, design and construction of buildings, dams, bridges, harbor works, water works, water and nuclear power facilities, sewage disposal works, nuclear waste facilities, and transportation systems including highways, railways, waterways, airports and pipe lines. Graduates in civil engineering are in demand by public agencies and by private industries. Employment varies from assignments in design offices or in the field, in small communities or large industrial centers.

The Department of Civil Engineering offers programs of study which provide adequate academic preparation to those contemplating a career in the civil engineering profession. The undergraduate program provides a sound general education and prepares the student for advanced study either by graduate study (see listing of graduate degrees offered) or by self-study.

FACILITIES

Learning is facilitated by laboratories for testing structural materials, large models or full-scale structures, soils and bituminous products, for hydraulic experiments, for studies in airphoto interpretation and photogrammetry, for analysis of small structural models, for chemical and biological tests pertaining to sanitary engineering, and for the investigation of transportation problems.

UNDERGRADUATE CURRICULA

Two four-year undergraduate curricula are offered; one leads to a Bachelor of Science in civil engineering; the other, to a Bachelor of Science in civil engineering, construction option.

The civil engineering curriculum is a balanced program providing academic discipline in the pure and applied physical sciences, the humanities and social sciences, and the professional aspects of civil engineering including structural, transportation and sanitary engineering, and soil mechanics and foundations.

The curriculum in the civil engineering construction option is designed for those interested in the construction phases of civil engineering. It includes the core course requirements in the physical sciences and the social sciences and humanities as established for all N. C. State engineering curricula. The curriculum includes a three semester sequence of courses in cost analysis and control, and construction methods and planning. The courses, unique to this curriculum, are designed to provide academic discipline in the engineering, planning and management aspects of construction.

CIVIL ENGINEERING CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 202 Introduction to Civil Engineering*	2	GY 120 Elements of Physical Geology†	2
CE 213 Introduction to Mechanics	3	GY 110 Physical Geology Laboratory†	1
MA 202 Analytic Geometry & Calculus III	4	MAT 200 Mechanical Properties of Structural Materials	2
PY 208 General Physics	4	CE 313 Mechanics of Solids	3
Humanities & Social Science*	3	MA 301 Applied Differential Equations I	3
Physical Education	1	Humanities & Social Science*	3
	17	Free Elective	3
		Physical Education	1
			18

† May be taken in reverse semesters.

JUNIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 301 Engineering Surveying	3	CE 305 Transportation Engineering I	4
CE 325 Structural Analysis	3	CE 325 Structural Engineering I	4
CE 332 Materials of Construction	3	CE 342 Soils Engineering I	4
CE 382 Hydraulics	4	CE 353 Water Resources Engineering I	4
IE 311 Engineering Economic Analysis	3		
	16		16

SENIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE Electives**	6	CE 450 Civil Engineering Design	3
Engineering Science Elective***	3	CE Elective	3
Free Elective	3	Free Elective	3
Humanities & Social Science*	3	Humanities & Social Science*	6
	15		15

Hours Required for Graduation 132

* Humanities and social science courses to be selected from the standard school pattern

** Two courses selected from: CE 406 Transportation Engineering II

CE 427 Structural Engineering II

CE 443 Soils Engineering II

CE 484 Water Resources Engineering II

*** Thermodynamics, mechanics, electrical engineering or materials engineering

CONSTRUCTION OPTION CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 202 Introduction to Civil Engineering†	2	GY 120 Elements of Physical Geology†	2
MA 202 Analytic Geometry & Calculus III	4	GY 110 Physical Geology Laboratory†	1
PY 208 General Physics	4	MAT 200 Mechanical Properties of Structural Materials	2
CE 213 Introduction to Mechanics	3	CE 313 Mechanics of Solids	3
Humanities & Social Science*	3	MA 301 Applied Differential Equations	3
Physical Education	1	Free Elective	3
	17	Physical Education	1
			18

† May be taken in reverse semesters

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 301 Engineering Surveying	3	CE 305 Transportation Engineering I	
CE 325 Structural Analysis	3	or	
CE 332 Materials of Construction	3	CE 383 Water Resource Engineering I	4
CE 382 Hydraulics	4	CE 326 Structural Engineering I	4
IE 311 Engineering Economic Analysis	3	CE 342 Soils Engineering I	4
	16	CE 365 Construction Engineering I	4
			16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CE 463 Cost Analysis and Control	3	CE 460 Construction Engineering Project	3
CE 466 Construction Engineering II	3	CE 464 Legal Aspects of Contracting	3
Engineering Science Elective**	3	Free Elective	3
Free Elective	3	Humanities & Social Science*	6
Humanities & Social Science*	3		15
	15		
		Hours Required for Graduation	132

* Humanities and Social Science courses to be selected from standard school pattern.

** Thermodynamics, Mechanics, Electrical Engineering or Materials Engineering.

POST-BACCALAUREATE STUDY IN CIVIL ENGINEERING RELATED TO OTHER FIELDS

Transportation Engineering or City and Regional Planning—There is a need for the coordination of transportation facilities and land planning. To fulfill this need, an advanced program leading to a post-baccalaureate degree in engineering with a major in transportation engineering, and to the degree of Master of Regional Planning is offered through the combined resources of the Department of Civil Engineering at North Carolina State University and the Department of City and Regional Planning at the University of North Carolina at Chapel Hill.

The minimum residence requirements include two academic years plus a summer internship. A bachelor's degree in engineering, including a knowledge of transportation engineering from an institution of recognized standing is required for admission to the program. Applicants who do not meet these requirements in full may submit their credentials for examination and consideration.

Further information may be obtained from the co-sponsoring departments.

Water Resources—To meet industry's need for personnel with training in water supply and the abatement of water pollution, students in the many curricula leading to positions in industry (food processing, textile chemistry, pulp and paper technology, chemical engineering, zoology and others) may consider courses in sanitary engineering for advanced un-

dergraduate electives and for minor sequences for advanced degrees. Among appropriate courses are: CE 484, Water Resources Engineering II; CE 571, Theory of Water and Waste Treatment; CE 573, Unit Operations and Processes in Waste Treatment; CE 673, Industrial Water Supply and Waste Disposal; CE 674, Stream Sanitation.

In addition to programs in water supply and pollution control, students may major in hydraulics and hydrology. For further information write the Department of Civil Engineering

ELECTRICAL ENGINEERING

Daniels Hall

Associate Professor J. F. Kauffman, Acting Head of the Department

Professor N. F. J. Matthews, Graduate Administrator

Assistant Professor L. R. Herman, Acting Coordinator of Advising

Professors: W. J. Barelay, W. Chou, A. R. Eckels, W. A. Flood, J. R. Hauser, M. A. Littlejohn, J. B. O'Neal Jr., D. R. Rhodes, J. Staudhammer; *Adjunct Professor:* J. J. Wortman; *Professors Emeriti:* G. B. Hoadley, W. D. Stevenson Jr., F. J. Tischer, *Associate Professors:* N. R. Bell, W. T. Easter, J. W. Gault, T. H. Glason, A. J. Goetze, J. J. Grainger, E. G. Manning, W. C. Peterson, R. W. Stroh; *Adjunct Associate Professors:* S. M. Bedair, E. C. Christian, R. L. Pimmel, J. R. Suttle, A. Thanikachalam, M. G. Zaalouk; *Associate Professors Emeriti:* K. B. Glenn, W. P. Seagraves, E. W. Winkler; *Assistant Professors:* W. A. Gruver, L. R. Herman, C. M. Krowne, S. H. Lee, W. E. Snyder, R. J. Trew; *Adjunct Assistant Professors:* G. F. Bland, J. W. Harrison, A. Jai, A. T. Shankle, H. R. Whitmann; *Adjunct Instructors:* J. E. Andrews, R. L. Earp

Electrical engineering includes such specialized fields as communication, computer, electric power, electronic and microwave engineering. The student is prepared for any of these professional activities by starting with a thorough grounding in engineering science followed by fundamental electrical theory and advanced subject matter. The advanced subject matter is offered through elective courses which emphasize antennas, radio wave propagation, automatic control, micro computers, digital systems, communications, telemetering, electronics, the design of electrical and electronic systems, electrical power production, the utilization of electric power, electronics in medicine, instrumentation, semiconductor devices, integrated circuits, and other vital and rapidly developing concerns. By appropriate choice of elective courses a student may follow a suggested program in one of the specialized fields of electrical engineering or may choose electives to achieve an individualized program of study.

CURRICULUM

The curriculum in electrical engineering includes comprehensive training in mathematics and physics fundamental sciences—and adequate training in allied branches of engineering. The electrical engineering courses specified in the curriculum during the sophomore and junior years provide the fundamental electrical theory for all EE majors. Specialization is achieved primarily during the senior year through appropriate choices of elective courses. Most courses are accompanied by coordinated work in the laboratory and by application of theory in the solutions to carefully planned problems. Laboratories are for the study of servomechanisms and control, electronic circuits, instrumentation, computers, communications, microwaves, antennas, electromagnetic fields and waves, electric filters and electrical machinery. Also there are a number of research laboratories, especially in solid-state electronics, computers, electromagnetics and communication systems.

Each student, with a faculty adviser's assistance, is required to plan a coordinated program which will meet the requirements for a Bachelor of Science in electrical engineering. Qualified students may coordinate their senior year with a plan for graduate study (see listing of graduate degrees offered).

In addition to School of Engineering graduation requirements, attendance at two professional electrical engineering society meetings, one in the junior year and one in the senior year, is required.

Also a minimum of six continuous weeks of gainful employment is required. A wide variety of employment may be used, but technical work while in military service or for a

school does not satisfy this requirement. Evidence of employment will consist of a letter from the employer setting forth inclusive dates of employment, character of work performed and an evaluation of the student's work.

ELECTRICAL ENGINEERING CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EE 201 Electric Circuits I	4	EE 202 Electric Circuits II	4
MA 202 Anal. Geom. Calc. III	4	CE 213 Intro. to Mechanics	3
PY 208 General Physics II	4	MA 301 Applied Diff. Equat. I	3
Humanities and Social Science	3	Humanities and Social Science	3
PE 2 P.E.	1	Free Elective	3
	16	PE 2 P.E.	1
			17
JUNIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EE 302 Numerical Appl. in EE	3	EE 301 Linear Systems	3
EE 311 Electronic Circuits	4	EE 305 Electric Power Systems	4
EE 303 Electromagnetic Fields	4	EE 340 Digital Systems	4
ENG 321 Comm. of Tech. Infor.	3	Approved Technical Elective***	3
Free Elective	3	Humanities and Social Science	2
	17		17
SENIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EE 4 Approved Dept. Elective**	3	EE 4—Approved Dept. Elective**	3
EE 4 Approved Dept. Elective**	3	EE 4 Approved Dept. Elective**	2
Approved Technical Elective***	3	MAE 301 Engineering Thermodynamics I	3
Humanities and Social Science	3	Humanities and Social Science	3
Approved Engr. Sci. Elective*	3	Free Elective	3
	15		15
		Total Credit Hours for Graduation	132

* Chosen from an approved list of Engineering School electives (not EE courses).

** Chosen from an approved list of 400 level EE courses. Students with B or better average in EE and Math may use 500-level courses.

*** Chosen from an approved list of Math, Physics, Statistics, and Computer Science courses.

COMPUTER STUDIES PROGRAM

Daniels Hall

Professor: W. Chou, Director

Associate Professor: W. E. Robbins, Associate Director

Professors: W. S. Galler, H. J. Gold, D. C. Martin, J. B. O'Neal, J. Staudhammer; Professor Emeritus: P. E. Lewis, Associate Professors: E. W. Davis, R. J. Parnaro, J. W. Gault, T. L. Honeycutt, L. Mansfield, J. D. Powell, J. C. Smith, R. S. Sowell, A. L. Tharp; Adjunct Associate Professor: J. R. Sottler; Assistant Professors: L. E. Delmel, W. A. Gruver, J. W. Hanson, D. M. Latch, C. D. Savage, W. E. Snyder, R. E. Stinner, R. W. Stroh, K. C. Tai, N. F. Williamson; Visiting Assistant Professors: A. Nilsson, M. Posefsky, R. D. Rodman, J. W. Smith, W. J. Stewart; Instructors: C. E. Grad, M. J. Lee

The Computer Studies Program is an interdisciplinary graduate program which is administratively supported by the Departments of Computer Science and Electrical Engineering with participation by faculty members primarily from Computer Science, Electrical Engineering and Operations Research.

The program integrates the computer software oriented curriculum of the Department of Computer Science and the computer hardware oriented curriculum of the Department of Electrical Engineering into a single curriculum.

The program offers Master of Science and Master of Computer Studies degrees. A joint computer studies/operations research Ph.D. is offered through the Operations Research Program.

ENGINEERING OPERATIONS

Riddick Hall

Associate Professor W. T. Easter, Director and Coordinator of Advising

Engineers not only design equipment and structures; they operate and control production systems, perform management and supervision at all levels, plan and maintain plant facilities, and market technical products. These latter functions may be grouped together under the general term "operations" the ongoing tasks of providing needed goods and services in an economical, safe and healthful manner. Engineering careers in operations are well suited to persons who have interests in both technical and business matters and who find satisfaction in accomplishing objectives through working with people. This program provides educational background for such careers.

CURRICULUM

Engineering operations is an interdepartmental program of study leading to the Bachelor of Science degree. Starting with a foundation of basic arts and sciences, the curriculum builds a thorough grounding in engineering fundamentals along with a strong introduction to the principles of business management. Additional depth in an area of the student's choice is provided by a technical elective sequence taken in the junior and senior years. A student may choose from four standard sequences production control, electrical, industrial ceramics, and manufacture of musical instruments or may design a special sequence related to individual interests.

The sequence in manufacture of musical instruments, established in 1978, is open only to students with demonstrable proficiency in playing at least one musical instrument. With this technical sequence the engineering operations curriculum offers a unique opportunity for study of musical instruments from a scientific as well as an aesthetic viewpoint.

With the individualized technical sequence the curriculum becomes a broad and flexible engineering program adaptable to a wide variety of individual educational needs.

JOINT PROGRAMS

The School of Engineering operates joint programs in engineering operations (production control sequence) which permit taking up to 93 of the required credits at either the University of North Carolina at Asheville or at Wilmington. Additional details are given in the UNC-A and UNC-W catalogs.

OPPORTUNITIES

Engineering operations graduates find careers not only in manufacturing companies, but also in governmental agencies and in service firms such as utilities, contractors, consultants, financial institutions and transportation companies.

Those who wish further education typically go into master's programs in management or business administration. Some, however, enter other professional schools such as law and medicine.

ENGINEERING OPERATIONS CURRICULUM

See the freshman year, School of Engineering

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 202 Analytic Geometry and Calculus III	4	MAT 201 Structure and Properties of Engineering Materials	3
PY 208 General Physics	4	ACC 260 Accounting I Concepts of Financial Reporting	3
CE 211 Introduction to Applied Mechanics	3	CE 212 Mechanics of Engineering Materials	3
E 207 Engineering Graphics II	2	Humanities and Social Sciences	3
Humanities and Social Sciences	3	Free 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>
MAE 307 Energy and Energy Transformations	3	EE 350 Introduction to Industrial Power Systems	3
ST 361 Introduction to Statistics for Engineers	3	IE 301 Engineering Economy	3
ACC 262 Managerial Uses of Cost Data	3	IE 328 Manufacturing Processes	3
CSC 111 Introduction to Fortran Programming	2	Technical Sequence	3
Technical Sequence	3	Free Elective	3
Humanities and Social Sciences	3		15
	17		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EB 202 Economics II (or)	3	IE 420 Manufacturing Controls	3
EB 326 Personnel Management	3	Technical Sequence	6
EO 491 Seminar in Engineering Operations	1	Humanities and Social Sciences	3
Technical Sequence	6	Free Elective	3
Humanities and Social Sciences	3		15
Free Elective	3	Hours Required for Graduation	131
	16		

- Students may follow a standard or an approved individualized technical sequence. Sequence credits in excess of 18 may be used for free electives.
- Courses in the humanities and social sciences are to follow the standard requirement for the School of Engineering.
- Credits in MA 111 may not be used for any curriculum requirement.
- No restriction is placed on which of the courses used to fulfill graduation requirements may carry D grades.

TECHNICAL ELECTIVE SEQUENCES

JUNIOR		F	S	SENIOR		F	S
1. PRODUCTION CONTROL (total 19 hours)							
EB 332 Industrial Relations		3		IE 332 Motion and Time Study		4	
IE 443 Quality Control		3		IE 343 Plant Layout and Materials Handling		3	
			3	Technical Electives		3	3
							7
2. ELECTRICAL (total 20 hours)							
Alternate credits will be substituted for EE 350, Introduction to Industrial Power Systems (3).							
EE 201 Electrical Circuits I		4		EE 314 Electronic Circuits		4	
EE 202 Electric Circuits II		4		EE 340 Fundamentals of Digital Systems		4	
			4	EE 305 Electric Power Systems		4	4
							8
JUNIOR		F	S	SENIOR		F	S
3. INDUSTRIAL CERAMICS (total 19 hours)							
MAT 311 Ceramic Processing I		4		MAT 417 Ceramic Subsystem Design		3	
MAT 312 Ceramic Processing II		3		Technical Electives		6	3
			3				6
							9

4. MANUFACTURE OF MUSICAL INSTRUMENTS (total 21 hours)

Prerequisite: Satisfactorily passing audition for MUS 100, Instrumental Music

ACC 962N will be taken instead of ACC 262. Two of the following three courses will be taken in place of ACC 260 and the EB 302 choice: EB 325, Personnel Management; EB 332, Industrial Relations; PSY 337, Psychology, Industrial Society. Nine hours of humanities will consist of MUS 301, Basic Music Theory 3), and six additional hours of humanities electives in music at or above the 200 level (not to replace the requirements in history, literature, and economics).

Acoustics of Music	3	IE 332 Motion and Time Study	4
IE 443 Quality Control	3	IE 343 Plant Layout and Materials Handling	3
MAT 310 Physical Examination of Materials	2	MAT 490 Materials Engineering Projects	3
	3 0	MAT 495 Engineering Operations Projects	3
		Construction of Musical Instrument	3
			7 6

5. INDIVIDUALIZED (minimum 18 hours)

Students having well-defined career interests which are not adequately served by the standard technical sequences are encouraged to propose sequences tailored to their specific needs. Further information may be obtained from the program director.

INDUSTRIAL ENGINEERING

Riddick Engineering Laboratories

Professor W. A. Smith Jr., Head of the Department

Professor J. R. Canada, Coordinator of Advising

Professors S. E. Elmaghraby, R. G. Pearson, A. L. Prak, Associate Professors: R. E. Alvarez, M. A. Ayoub, R. H. Bernhard, J. J. Hardier, H. L. W. Nuttle, S. Stidham Jr.; Assistant Professors: E. L. Blair, E. J. Pheasant; Instructor: C. T. Culbreth; Visiting Lecturers: J. A. Ekwall, S. G. Isley; Adjunct Associate Professor: R. L. Launer; Adjunct Assistant Professor: M. J. Goodman; Professors Emeriti: C. A. Anderson, R. G. Carson Jr., R. W. Llewellyn

The industrial engineer designs, improves and installs integrated systems of people, materials, equipment, and information. One draws 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, improvements for many diverse activities, such as a hospital, a department store, a manufacturing enterprise, an insurance office or government functions. His or her position in an organization is usually as a management adviser 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.

Industrial engineering's undergraduate program leads to a Bachelor of Science degree in industrial engineering. See listing of graduate degrees offered. The department also offers a Bachelor of Science in furniture manufacturing and management.

INDUSTRIAL ENGINEERING CURRICULUM

See the freshman year School of Engineering

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
IE 200 Introduction to IE	1	MAT 201 Struct Prop Engr. Mtl.	3
MA 202 Analy. Geom & Calc III	4	IE 311 Engineering Econ. Analysis	3
PY 208 General Physics	4	MA 303 Linear Analysis	3
CSC 111 Intro to Fortran Programming	2	ST 371 Intro to Prob. & Dist. Theory	2
Humanities and Social Sciences	3	MAE 206 Engineering Statics	3
Physical Education	1	Physical Education	1
	15		15

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ACC 262N Manag'l Uses of Cost Data	3	IE 308 Control of Prod. & Serv. Sys.	4
ST 372 Intro to Stat Inference & Regression	2	IE 352 Work Analysis & Design	3
IE 307 Business Data Processing	3	IE 401 Stochastic Models in IE	3
IE 361 Deterministic Models in IE	3	Humanities & Social Science	3
Humanities & Social Science	3	Free Elective	3
IE 351 Manuf. Engr	3		16
	17		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EE 331 Principles of Elec Engrg	3	Technical Electives (2)	6
IE 452 Ergonomics	3	Engineering Science Elective	3
Technical Elective	3	Humanities & Social Science	3
Engineering Science Elective	3	Free Elective	3
Humanities & Social Science	3		15
Free Elective	3		
	18	Hours Required for Graduation	131

FURNITURE MANUFACTURING AND MANAGEMENT

James T. Ryan Professor Anco L. Prak, In Charge

Instructor: C. T. Culbreth; Furniture Extension Specialist: E. L. Clark, Lecturer: J. A. Ekwall

The furniture industry ranks second only to the automobile as a producer of consumer durable goods. The industry is the second largest industrial employer in North Carolina and produces over 25 per cent of the furniture made in the U.S.A. The industry is changing rapidly with the introduction of mechanization, new materials and sophisticated management controls.

The furniture manufacturing and management program is the only one of its kind in the country. It receives industry support and guidance. Plant and market field trips combined with project type instruction give students in-depth understanding of manufacturing. The faculty keeps abreast of industry problems through close contact with the Southern Furniture Manufacturers Association and by doing applied research and extension work.

The cooperative education program is well suited to the furniture manufacturing and management curriculum.

CURRICULUM

The degree of Bachelor of Science in furniture manufacturing and management prepares graduates for technical and managerial positions in the industry.

The curriculum stresses the application of engineering and technology to furniture manufacturing. Related subjects such as management, accounting and economic analysis cover the business side of modern furniture production systems.

In addition to academic course work, a minimum of six weeks of continuous, gainful employment in a furniture manufacturing plant is required. Usually, such employment is between the junior and senior years.

FURNITURE MANUFACTURING AND MANAGEMENT CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR

Full Semester	Credits	Spring Semester	Credits
CSC 111 Introduction to Fortran Programming	2	ACC 262N Managerial Uses Cost Data	3
SP 110 Public Speaking	3	IE 241 Furn Mfg Processes I	3
E 240 Furnitures Graphics	3	ST 361 Intro. to Stat. for Engrs.	3
PY 212 General Physics	4	WPS 201 Elements of Wood	3
IE 200 Intro to Ind Engineering	1	Humanities & Soc. Science	3
Humanities & Soc. Science	3	Physical Education	1
Physical Education	1		16
	17		
WPS 205 Wood Products Practicum			5

JUNIOR YEAR

Full Semester	Credits	Spring Semester	Credits
IE 307 Business Data Processing	3	IE 301 Engineering Economy	3
IE 332 Motion & Time Study	4	IE 341 Furn Plant Layout & Design	3
IE 340 Furn. Mfg Processes II	4	IE 371 Furn Quality & Prod. Cont.	4
IE 345 Principles of Upholstery	2	Free Elective	3
Humanities & Soc. Science	3	Technical Elective	2
	16		15

SENIOR YEAR

Full Semester	Credits	Spring Semester	Credits
IE 470 Furn Mfg Organization	2	EB 325 Personnel Management or	3
Humanities & Soc. Science	3	EB 332 Industrial Relations	3
Free Elective	3	IE 440 Furn. Management Analysis	3
Technical Elective	4	Free Elective	3
	12	Technical Elective	2
		Humanities & Soc. Science	3
			14

Hours Required for Graduation

MATERIALS ENGINEERING

Page Hall

Professor W. W. Austin Jr., Head of the Department and Coordinator of Advising

Professors: J. R. Beeler Jr., R. B. Benson Jr., A. A. Fahmy, J. K. Magor, C. R. Manning Jr., K. L. Meazed H. Palmour III, H. Stadelmaier, R. P. Stoops, Adjunct Professors: H. M. Davis, G. Maser, Professor Emeritus: W. W. Krieger; Associate Professors: R. F. Davis, J. V. Hamme, G. O. Harrell, Adjunct Associate Professor: J. C. Hurt, Assistant Professors: M. L. Fiedler Morrison, L. T. Jordan, Adjunct Assistant Professor: P. A. Parrish, Special Lecturer: K. R. Brose

The Department of Materials Engineering offers education, research and professional development which qualifies graduates as technical and administrative leaders for industries and government agencies involved with design, development, selection and processing of engineering materials. Typical industries served by materials engineers are: aerospace, electrical and electronics, construction, nuclear power and transportation.

OPPORTUNITIES

Materials engineer's job opportunities include those in research and development of new materials needed in the rapidly expanding fields of chemical, mechanical, aerospace, electronic and nuclear technology. With the continued industrial development of the South and the State of North Carolina, opportunities are developing for materials engineers to play a vital role in maintaining state and regional progress.

Professional training in materials engineering provides opportunities for employment in industries producing or consuming essential products including metals and alloys, glass in all its forms, enamels and protective coatings for metals, structural clay products such as brick and tile, thermal insulators, electrical insulators, electronic devices, plastics, and composite materials.

CURRICULUM

The undergraduate curriculum is comprised of a three-year program of fundamental courses followed by a fourth year in which the student chooses a specialty area: ceramic engineering, metallurgical engineering, polymeric materials, materials processing, or materials engineering (general). A fifth year professional program is available for advanced work and further specialization in these fields.

Graduate degrees are available (see listing of graduate degrees offered and consult the Graduate Catalog).

Well-equipped laboratories aid research and instruction in: Auger spectroscopy, x-ray diffraction, differential thermal analysis, thermogravimetric analysis, electron microprobe analysis, radiography, metallography, electron microscopy, mechanical behavior of materials, and nuclear fuel research.

MATERIALS ENGINEERING CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 202 Anal. Geometry & Cal. III	4	MA 301 Applied Differential Equat.	3
PY 208 General Physics	4	CSC 111 Intro. to Fortran Programming	2
Humanities & Social Science	3	MAE 206 Engineering Statics	3
Physical Education	1	EE 331 Principles of Elec. Engineering	4
Free Elective	3	EE 339 Prin. Elec. Engr. Lab	0
MAT 203 Orientation to Mats. Eng. I	1	MAE 301 Engr. Thermodynamics I	3
	16	Physical Education	1
		MAT 204 Orientation to Materials Engineering II	1
			17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAT 301 Equil. & Rate Processes in Materials Science	3	MAT 302 Materials Processing	3
MAT 320 Phase Diagrams & Crystals	3	MAT 310 Physical Exam. of Mats.	2
Humanities & Social Science	3	MAT 321 Phase Transf. & Diff.	3
MAE 314 Solid Mechanics	3	Free Elective	3
Free Elective	3	Humanities & Social Sci.	3
MAT 450 Mechanical Prop. of Mats.	3	Technical Elective	3
	18		17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAT 411 Phys. Prin. in Mat. Sci. I	3	MAT 423 Matls. Factors in Design I	3
MAT 431 Physical Metallurgy I	3	CHE 325 Introduction to Plastics	3
MAT 435 Physical Ceramics I	3	Humanities & Social Sci.	3
Technical Elective	3	Technical Electives	6
Humanities & Social Sci.	3		15
	15	Hours Required for Graduation	133

MECHANICAL AND AEROSPACE ENGINEERING

Broughton Hall

Professor C. F. Zorowski, Head of Department

Professor J. C. Williams III, Associate Head of Department

Professor B. H. Garcia Jr., Coordinator of Advising

Professors: J. A. Bailey, F. R. DeJarnette, J. A. Edwards, W. C. Griffith, F. J. Hale, F. D. Hart, H. A. Hassan, T. H. Hodgson, E. G. Humphries, R. B. Knight, J. C. Mulligan, M. N. Osisik, J. N. Perkins, L. H. Royster, F. O. Smetana, F. Y. Sorrell, J. K. Whitfield, J. Woodburn; Adjunct Professors: J. J. Murray, E. A. Saibel; Professors Emeriti: H. B. Briggs, M. H. Clayton, J. S. Doolittle; Associate Professors: E. M. Afify, J. R. Bailey, C. J. Maday, C. J. Moore Jr., W. F. Reiter Jr.; Associate Professor and Extension Specialist: H. M. Eckerlin; Adjunct Associate Professors: E. S. Armstrong Jr., J. F. Campbell Jr., E. Singleton, Associate Professor Emeritus: W. E. Adams; Assistant Professors: A. C. Eberhardt, J. S. Srenkowaki; Visiting Assistant Professor: C. P. Ford III; Adjunct Assistant Professors: G. Y. Anderson, F. O. Carta, P. B. Corson, T. W. Sigmon, J. R. Yow; Assistant Professor Emeritus: T. J. Martin Jr.; Instructors: G. O. Batton, Christa M. Weinbrook; Visiting Instructor: J. H. Hebrank; Adjunct Instructors: H. G. Hoomani, J. E. McLain; Extension Specialist: A. S. Boyers

Mechanical engineers specialize in the generation of power and the design of machines and processes that apply mechanical and thermal energy to useful purposes. Example areas of specialization include conventional (fossil fuel) power generation; novel power sources (solar, wind, tides, etc.); internal combustion, diesel and turbine engines; heating, air conditioning and refrigeration; air, sea and land vehicles; all types of mechanical devices, systems, and machinery; domestic and commercial appliances; instrumentation and industrial controls; and air, noise, and thermal pollution abatement systems.

Aerospace engineering shares responsibility for many of the areas listed above but is principally concerned with the design and analysis of the performance, stability, and control of modern aircraft, both commercial and private, and space vehicles; all types of mechanical devices, systems, and machinery; vehicle propulsion systems; and aerodynamics—the interaction between the vehicle and the atmosphere.

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 personality. In addition the programs provide the student with an opportunity to begin developing the skills of applying his or her acquired knowledge and specializing in a specific area of discipline interest. The Bachelor of Science degree is available in both aerospace engineering and mechanical engineering. Graduate degrees are also offered (see listing of graduate degrees offered and consult the Graduate Catalog).

FACILITIES

The academic programs in Mechanical or Aerospace Engineering are augmented by extensive laboratory facilities available for practical experience in engineering systems. Mechanical Engineering facilities include instrumentation, acoustic and vibration, photoelasticity, stress analysis, dynamometry, heat transfer, materials processing and design laboratories. Aerospace engineering facilities include subsonic, transonic, and supersonic wind tunnels, aerospace structures and propulsion laboratories.

OPPORTUNITIES

Since all industry uses machinery and power, and mechanization is expanding the world over, mechanical engineering provides career and employment opportunities which are vir-

tually limitless. Mechanical engineers are needed in every technology-oriented industry as well as in such fields as law and medicine.

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.

Mechanical engineers and aerospace engineers find opportunities in design, production, testing, operation and maintenance, research and development, marketing and sales, management and teaching. Opportunities are limited only by the capabilities and professional training of the individual.

MECHANICAL ENGINEERING CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 22 Analytic Geometry and Calculus III	4	MAE 216 Elements of Mechanical Engineering	3
PY 208 General Physics	4	MA 301 Applied Differential Equations I	3
MAE 206 Engineering Statics	3	MAE 208 Engineering Dynamics	3
Humanities, Social Sciences*		CSI* 111 Intro. to Fortran Programming	2
Free Elective	3	Humanities, Social Sciences*	
Physical Education	1	Free Elective	3
	15	Physical Education	1
			15
JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 301 Engineering Thermodynamics I	3	MAE 302 Engineering Thermodynamics II	3
MAE 305 Mechanical Engineering Laboratory I	1	MAE 306 Mechanical Engineering Laboratory II	1
MAE 316 Strength of Mechanical Components	3	MAE 310 Dynamics of Machines	3
EE 331 Principles of Electrical Engineering	3	EE 332 Principles of Electrical Engineering	3
MAT 201 Structure and Properties of Engineering Materials	3	MAE 308 Fluid Mechanics I	3
Humanities, Social Sciences*		Humanities, Social Sciences*	
Free Elective	3	Free Elective	3
	16		16
SENIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 401 Energy Conversion	3	MAE 402 Heat & Mass Transfer	3
MAE 402 Heat & Mass Transfer	3	MAE 401 Energy Conversion	3
MAE 400 Mechanical Engineering Laboratory III	1	MAE 416 Mechanical Engineering Design	4
MAE 410 Mechanical Engineering Analysis	3	Departmental Elective	3
Departmental Elective	3	Humanities, Social Sciences*	
Humanities, Social Sciences*		Free Elective	6
Free Elective	6	Free Elective	6
	16	Hours Required for Graduation	129

* Students may elect to take PY 201, 202 and 203 in place of PY 205, 208. Rearrangement of the schedule of courses to accomplish this will be worked out in consultation with the student's adviser.

* See information concerning the humanities, social science sequence for School of Engineering.

AEROSPACE ENGINEERING CURRICULUM

See the freshman year School of Engineering.

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 202 Analytic Geom. & Cal. III	4	MAE 261 Aero. Vehicle Performance	3
PY 206 General Physics	4	MA 301 Applied Differen. Equations	3
MAE 206 Engineering Statics	3	MAE 208 Engineering Dynamics	3
Humanities, Social Sciences		CSC 111 Introduction to Fortran Programming	2
or		MAT 201 Struc. & Prop. of Engr. Mat. I	3
Free Elective	3*	Physical Education	1
Physical Education	1		
	15		15

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 301 Engr. Thermodynamics I	3	MAE 356 Aerodynamics II	4
MAE 353 Aerodynamics I	4	MAE 365 Propulsion I	3
MAE 371 Aero. Vehicle Struct. I	3	MAE 435 Principles of Auto Control	3
EE 321 Prin. of Elec. Engr.	3	MAE 472 Aero. Vehicle Struct II	4
EE 339 Prin of Elec. Engr. Lab	1	Humanities, Social Sciences	
Humanities, Social Sciences		or	
Free Elective	3*	Free Elective	3*
	17		17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 478 Aero. Vehicle Design I	2	MAE 479 Aero Vehicle Design II	3
MAE 462 Flight Veh. Stab. & Con.	3	Departmental Elective	3
MAE 465 Propulsion II	4	Humanities, Social Sciences	
MAE 455 Boundary Layer Theory	3	or	
Humanities, Social Sciences		Free Electives	9*
or			15
Free Electives	6*	Hours Required for Graduation	132
	18		

* 27 credit hours of Humanities, Social Sciences and free electives of which 9 credit hours are free electives and 18 credit hours are Humanities and Social Sciences which must be taken from an approved list.

NUCLEAR ENGINEERING

Burlington Engineering Laboratories

Professor T. S. Elleman, Head of the Department

Associate Professor E. Stam, Coordinator of Advising

Professors R. P. Gardner, R. L. Murray, R. F. Saxe, K. Verghese, L. R. Zumwalt; Associate Professors J. R. Bohannon Jr., C. E. Siewert; Extension Specialist: J. Kohl, Health Physicist R. D. Cross; Reactor Engineer W. L. Dunn

Nuclear engineering is concerned with the engineering aspects of the control, release and utilization of nuclear energy. Nuclear reactors serve many functions they serve as heat sources for economical 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.

OPPORTUNITIES

Although the nuclear industry is relatively young, it already represents a major national effort. Reactor development and construction will continue to grow as we become in-

creasingly reliant upon nuclear energy as a substitute for energy from fossil fuels. Industrial applications of radiation will accelerate as the economic potential of such methods becomes even more firmly established. There continues to be a substantial need for nuclear engineers, especially by electric utilities, reactor manufacturers, and regulatory agencies.

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 or government 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.

Facilities for nuclear education include: a one-megawatt pulsing reactor (PULSTAR), which can be operated at a steady state of 1 MW or pulsed to 2200 MW; a cobalt-60 gamma source, 20,000 curies; solid state detectors and multi-channel analyzers for gamma-ray analysis; analog computers; digital computer, IBM System/360, Model 75; activation analysis laboratory; and high- and low-level radiochemistry laboratories.

NUCLEAR ENGINEERING CURRICULUM

See the freshman year School of Engineering

SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 32 Analytic Geometry and Cal III	4	MA 301 Appl Diff Equations I	3
PY 206 General Physics	4	PY 410 Introductory Nuclear Physics	3
MAT 211 Struc and Prop. Eng Mtls	3	CE 213 Introduction to Mechanics	3
CSC 111 Intro to Fortran Programming	2	NE 201 Appl of Nuclear Energy	3
Humanities and Social Sciences	3	Humanities and Social Sciences	3
Physical Education	1	Physical Education	1
	17		17
JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MAE 301 Engr Thermodynamics I	3	MA 401 Appl. Dif Equations II	3
EE 331 Principles of Electrical Engr.	3	EE 332 Principles of Electrical Engr.	3
MAE 308 Fluid Mechanics I	3	MAE 303 Engr. Thermodynamics III	3
NE 402 Fundamentals of Nucl Engr	4	NE 401 Reactor Analysis and Design	4
Humanities and Social Sciences	3	Free Elective	3
	16		16
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 Proj.	3
NE 404 Rad, Reactor, and Environmental Safety	3	NE 405 Reactor Systems	3
Technical Elective	3	NE Elective	3
Humanities and Social Sciences	3	Humanities and Social Sciences	3
Free Elective	3	Free Elective	3
	16		15
Hours Required for Graduation			132

PROFESSIONAL DEGREES

The School of Engineering offers professional curricula leading to the degrees 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 four-year undergraduate curricula.

Course work rather than research is emphasized in the professional degree program. The curriculum consists of a minimum of 30 credits which make up a planned program designed to fit the student's objective and which contains a minimum of 30 credit hours of course work at the 400 level or above, including at least 15 credit hours at the 500 level or above. Typical programs are available in the various departmental offices.

Admission Applicants who hold the bachelor's degree in engineering will be admitted to the professional program of the School of Engineering upon presentation of official credentials. For unconditional admission, these credentials must show the completion, with a minimum grade-point average of 2.5 (C+), of an amount of undergraduate work in the proposed field of professional study corresponding to that normally required for a bachelor's degree in that field.

Admission on a provisional basis may be granted applicants who do not meet the formal requirements. In case of insufficient preparation, prerequisite courses will be prescribed in addition to the normal program requirements.

Application should be filed in the office of the dean of the School of Engineering at least 30 days in advance of the semester in which admission is sought.

General Regulations—The following regulations of the School of Engineering will be observed:

- 1) An undergraduate enrolled at North Carolina State University who plans to undertake a professional program and who has fulfilled all requirements for the bachelor's degree, except for a few courses, may be permitted to enroll in courses for credit toward the professional degree provided the student has given notice of his purpose to the dean of the School of Engineering.

- 2) A limited amount of credit to be applied toward the requirements for the professional degree may be transferred to N. C. State from other institutions offering advanced work in engineering. Transfer of credit must be recommended by the head of the department in which the student does his major work and approved by the Dean of Engineering.

- 3) Professional students are classified as PR students and are subject to rules and regulations established by the Dean of Engineering.

- 4) Grades for completed courses are reported to the Dean 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 (C+) in all course work must be attained to satisfy requirements for a professional degree.

- 5) 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 Dean of Engineering.

- 6) Each professional student will be assigned an adviser in his or her major area. The adviser assists the student in preparing a program of study and counsels him or her in academic work. The student is required to prepare, with adviser's assistance, a complete plan of study before the end of the first semester in residence. This program of study is subject to approval by the Dean of Engineering.

SCHOOL OF FOREST RESOURCES

Biltmore Hall

E. L. Ellwood, *Dean*

L. C. Saylor, *Associate Dean and Coordinator of Advising*

The management and utilization of the South's forest resources and products provide opportunities for challenging professional careers. Forests provide a variety of goods—timber, water, wildlife and recreation environments vital to the economy and well being of North Carolina. Graduates of the School are qualified for professional positions managing forest lands, or producing the products or managing the services developed from these lands. Emphasis is placed on natural renewable resource management because the wise use of the products and amenities that can be derived from forest lands is central to preserving environmental quality and the quality of life.

North Carolina is an important forest state. Its 20 million acres of commercial forest land, comprising two-thirds of the state's land area, form the base for goods and services valued at approximately five billion dollars annually. Nearly 20 percent of the state's industrial labor force is associated with forest based organizations; forests support the southern region's largest industry. New wood-using industries continue to move into the South, creating multi-billion dollar outputs. Similarly, recreational activities continue to expand as a result of growing population, affluence, mobility and leisure time.

As a result of this growth, forest based industries and governmental agencies need well-educated, technically competent personnel.

Some of the programs in the School of Forest Resources are not duplicated in other Southern Universities, so the Trustees of the University and the Southern Regional Education Board have designated them as regional in nature. As a result no limit is set for enrollments of qualified out-of-state students.

DEGREES

The Bachelor of Science degree is conferred upon the satisfactory completion of any of the four-year undergraduate curricula listed below.

Graduate degrees offered include: Master of Science, Master of Forestry, Master of Recreation Resources, Master of Wood and Paper Science and the Doctor of Philosophy. Applicants should consult the Graduate Catalog for additional information.

FIELD INSTRUCTION AND EXPERIENCE

All students (except those in conservation) are required to present an equivalent of one summer of acceptable work experience. Students consult with their advisers as to what constitutes acceptable employment.

A summer camp is required of all forestry students. This camp follows the sophomore year for resident students. Transfer students attend the camp after completing the junior year at North Carolina State University.

Undergraduates enrolled in recreation resources administration complete a nine-weeks internship immediately following the completion of the junior year.

All pulp and paper majors spend at least one summer working in a pulp and paper mill designated by the University.

Wood science and technology students attend a summer practicum following the sophomore year; transfer students attend following the junior year.

Additional field instruction and scheduled trips to representative industries and agencies are required frequently as a part of regular class assignments.

HONORS PROGRAM

Students making exceptional academic records during their freshman year may, with faculty approval, follow an honors program. Honors students develop more rigorous programs of study, frequently taking advanced courses in mathematics, chemistry, statistics and economics. 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.

FOREST RESOURCES EXTENSION

The Forest Resources Extension program, a part of the Agricultural Extension Service, is the largest program of its type in the United States. It serves landowners, industries and public agencies in the areas of forestry, recreation, wildlife and wood and paper. Its primary responsibility is promoting the application of new ideas developed through research and experience.

In cooperation with the Continuing Education Division, short courses are offered in a number of fields to provide industry and government employees an opportunity to keep abreast of modern developments in techniques and equipment.

FACILITIES AND LABORATORIES

A school library and most classrooms are housed in Biltmore Hall. Among special education facilities in Forest Resources are: 80,000 acres in forests including the Hofmann forest on the coastal plain; the Hill, Schenck, Hope Valley and Goodwin Forests in the Piedmont; and the Slocum summer camp for sophomores at the Hill Forest in Durham county. Specialized laboratories unique to the South are the Hodges Wood Products Laboratory housing machining, gluing, finishing, preserving, testing and research laboratories, a saw-mill, a dry kiln and a veneer lathe; and the Robertson Laboratory with wood preparation, chemistry, pulping, testing and coloring laboratories, digesters and a small paper machine.

CURRICULA

Five curricula are administered in the School through its Departments of Forestry, Recreation Resources Administration and Wood and Paper Science. These programs provide a broad education in the biological and physical sciences as well as a sound cultural and professional background. Students are prepared for careers in the fields of conservation, forestry, recreation resources administration, pulp and paper science and technology, and wood science and technology.

Freshmen have a nearly common core of courses during the first semester allowing deferment of the final selection of a curriculum for two or three semesters. To assist students with a better understanding of their major area of study, introductory courses are given in each curriculum.

CONSERVATION

(Also see Agriculture and Life Sciences.)

M. G. Cook, *Major Adviser, School of Agriculture and Life Sciences*

L. C. Saylor, *Major Adviser, School of Forest Resources*

Conservation is wise use, perpetuation, or improvement of natural resources for the long-term benefit of society. Rapid urbanization and industrialization, and increasing population, are increasing pressures on the use of land areas for food and fiber, for wood and water and for recreation. These trends require trained people to make sound judgments in natural resources management and use.

The Schools of Forest Resources and Agriculture and Life Sciences—with strong programs in forestry, recreation, wood and paper science, ecology, soils, wildlife and the basic

biological sciences—jointly offer a baccalaureate program in conservation. Conservation graduates are trained in the basic concepts of several disciplines to apply a conservation philosophy to problem-solving in a modern society.

CURRICULUM

Depending upon interests, students enroll in either Forest Resources or Agriculture and Life Sciences. All programs in conservation have common core courses; specialty areas or minors are developed through elective courses.

Conservation provides a broad general education in natural resource management leading to a Bachelor of Science degree, rather than emphasizing technological aspects. Students desiring a more professional emphasis frequently combine the conservation program with a second degree. By the proper choice of electives, one may obtain a dual degree in fields such as botany, forestry, liberal arts, recreation, soil science, wildlife management and zoology.

CONSERVATION CURRICULUM

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ALS 103 Introductory Topics in ALS or FOR 101 Introduction to Forestry	1	CH 101 General Chemistry I	4
BO 200 Plant Life or BS 100 General Biology	4	ENG 112 Composition & Reading	3
ENG 111 Composition & Rhetoric	3	Humanity-Social Science Elective	3
Humanity Social Science Elective	3	MA 112 Analytic Geometry & Calculus A	4
MA 111 Algebra & Trigonometry	4	Physical Education	1
Physical Education	1		15
	16		
SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 103 General Chemistry II	4	BO 200 Plant Life or ZO 201 Animal Life	4
CH 107 Principles of Chemistry	3	English Elective	3
GY 120 Elements of Physical Geology	2	Free Elective	4
GY 110 Physical Geology Laboratory	1	SSC 200 Soil Science*	4
Humanity Social Science Electives	6	Physical Education	1
ZO 221 Conservation of Natural Resources	3		16
Physical Education	1		
	17		
JUNIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BO (ZO) 360 Introduction to Ecology	4	Biological Science Elective	3
Conservation Elective	3	Conservation Elective	3
RRA 241 Recreation Resource Rela- tionships	3	Humanity-Social Science Elective	3
Humanity Social Science Elective	3	PY 221 College Physics	5
ST 311 Introduction to Statistics	3	FOR 472 Renewable Resource Management	3
	16		17
SENIOR YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Biological Science Elective	3	Biological Science Elective	3
Conservation Elective	3	Conservation Elective	3
English Elective	3	Humanity-Social Science Elective	3
ZO 353 Wildlife Management	3	Free Electives	6
Free Electives	4		15
	16		
		Hours Required for Graduation	128

* Students with non-technical interests may substitute SSC 205 for SSC 200.

Elective courses may be used for emphasizing subject areas in communication, soils, wildlife biology, education and other areas.

FORESTRY

Biltmore Hall

Professor John W. Johnson, Head of Department

TEACHING AND RESEARCH

Professors: F. S. Barkalow Jr., R. C. Bryant, A. W. Cooper, E. B. Cowling, M. H. Farrer, L. F. Grand, W. L. Hasley, J. W. Johnson, D. E. Moreland (USDA), G. Namkoong (USFS), T. O. Perry, L. C. Saylor, R. R. Wilkinson, A. G. Wollum II, B. J. Zobel; *Adjunct Professors:* G. H. Hepting, E. G. Kuhlman, L. J. Metz, C. G. Wells, R. C. Winkworth; *Professors Emeriti:* T. E. Maki, W. D. Miller, R. J. Preston; *Associate Professors:* L. G. Jervis, F. P. Hain, J. D. Hair, A. E. Hassan, D. L. Holley, R. C. Kellison, D. H. J. Steensen, A. L. Sullivan; *Adjunct Associate Professors:* H. T. Schroeder, R. Stonecipher, H. A. Thomas; *Assistant Professors:* D. J. Frederick, T. V. Gemmer, J. D. Gregory, R. A. Lancia, R. J. Weir; *Adjunct Assistant Professor:* J. A. Barker; *Director, Forest Fertilization Cooperative:* R. Ballard; *Liaison Forest Soils Specialist:* M. Kane; *Liaison Geneticist:* J. B. Jett Jr.; J. R. Sprague, J. T. Talbert; *Liaison Silviculturist:* W. E. Gardner; *Instructor:* J. G. Learman; *Teaching Technician:* R. R. Braham; *Research Assistants:* D. W. Hazel, R. L. Zink

EXTENSION

Professors: W. T. Huxter, Leader Forestry Section, *Professors Emeriti:* W. M. Keller, F. E. Whitfield, *Associate Professors:* E. M. Jones; *Assistant Professors:* J. R. McGraw, W. M. Stanton, A. J. Weber; *Specialists:* D. W. Bachert, R. A. Hamilton, L. H. Harkins

CURRICULUM

The forestry curriculum provides students a basic educational background of biological, physical, and social sciences, humanities, mathematics and communication skills. Interspersed throughout the curriculum are forestry courses that deal with a wide variety of professional activities.

The goal of the program is a good education in the management and protection of rural and urban forest lands and resources, and the environment which they influence. Academic studies on campus are supplemented by practical laboratory exercises in forest areas, and the sophomore year is followed by an intensive 10-week summer camp experience in the Coastal Plain, Piedmont and Mountain regions of North Carolina.

Three months of acceptable work experience are required for graduation with a Bachelor of Science degree in forestry.

FORESTRY FIELDS OF SPECIALIZATION

The concentrations in forestry include a) general forestry, b) business operations, c) forestry biometry, d) watershed management, e) forest biology, f) wildlife management, g) forest mechanization, h) recreation, i) conservation, j) wood technology, and k) soil science. A student selects a concentration and schedules appropriate approved courses.

DUAL DEGREE PROGRAMS

Programs have been arranged with economics and business, entomology, recreation resources administration, soil science, and zoology, whereby students can obtain, in addition to the Bachelor of Science degree in forestry, a second Bachelor of Science degree in agricultural economics, conservation, entomology, recreation resources administration, soil science or wildlife biology. These joint programs usually require additional credits above the forestry concentration and free elective credits. Depending upon ability, students may carry additional credits in their four-year program or by enrolling for an extra semester or equivalent summer session.

OPPORTUNITIES

Graduates are in demand by state and federal land-managing agencies, by industrial concerns growing wood as a raw material, and by other organizations and agencies such as the agricultural extension service. Some graduates, after acquiring professional forestry experience, are self-employed as consultants and as operators or owners of forest-related businesses.

FORESTRY CURRICULUM

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BO 200 Plant Life	4	CH 103 (107) General Chemistry II or Prin. of Chemistry	4
MA 112 Analytic Geom. Calc. A	4	MA 212 Analytic Geom. Calc. B	3
CH 101 General Chemistry	4	ENG 112 Composition & Reading	3
ENG 111 Composition & Rhetoric	3	FOR 210 Dendrology (Gymnosperms)	2
FOR 101 Introduction to Forestry	1	Humanity-Social Science Elec	3
Physical Education	1	Physical Education	1
	17		16
SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PY 221 College Physics	5	EB 212 Economics of Agriculture	3
WPS 202 Wood Struc. Prop. I	3	FOR 272 Forest Mensuration	3
FOR 211 Dendrology (Angiosperms)	2	SSC 200 Soil Science	4
FOR 201 Intro. to For. Mensuration	2	Humanity-Social Science Elec.	3
English Speech Elec.	3	Free Elective	3
Physical Education	1	Physical Education	1
	16		17
SUMMER CAMP			
	FOR 204 Silviculture	2	
	FOR 263 Dendrology	1	
	FOR 264 Forest Protection	2	
	FOR 274 Map & Mensuration	4	
	FOR 284 Utilization	1	
		10	

All students select a concentration by the beginning of the junior year at the latest.

JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 301 Intro. to Forest Insects	3	FOR 452 Silvics	4
ST 311F Intro. to Statistics	3	FP (FOR) 218 Forest Pathology	4
FOR 219 Forest Econ. & Oper.	3	Humanity-Social Science Elec.	3
Humanity-Social Science Elec	3	Concentration Requirement	3
Concentration Requirement	3	Free Elective	3
	15		17
WORK EXPERIENCE*			
SENIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
FOR 405 Forest Land Management	5	FOR 406 Forest Land Inventory and Planning	6
Concentration Requirements	8	Concentration Requirements	9
Free Elective	3		15
	16		
		Hours Required for Graduation	139

The Freshman year course offerings as shown here assume that entrance test scores suggest readiness for MA 112 and CH 101. Appropriate substitutions will be made where test scores indicate the need to start at a different level.

* Three months of acceptable work experience are required for graduation.

RECREATION RESOURCES ADMINISTRATION

Biltmore Hall

Professor M. R. Warren Jr., Head of the Department

Professor R. E. Sternloff; Professors Emeriti: T. I. Hines, W. E. Smith, Associate Professor: P. K. McNelly; Adjunct Associate Professor: J. S. Stevens Jr.; Associate Professors Emeriti: G. A. Hamman, L. L. Miller, C. C. Scott; Assistant Professors: L. E. Abbas, H. A. Devine, S. L. Kirsch, P. S. Rea, C. D. Siderelis, D. D. Tarbet; Adjunct Assistant Professors: H. K. Cordell, J. H. Mose; Teaching Technicians: B. E. Wilson; Visiting Instructor: C. S. Love; Adjunct Instructors: R. L. Buckner, W. C. Singletary Jr.

Standards adopted by the recreation profession make college graduation a requirement for professional recreation employment. North Carolina State University has facilities, staff, curriculum, program and an established reputation for comprehensive professional education in recreation and parks. The program is nationally accredited.

The curriculum of Recreation Resources Administration offers a broad general educational background, basic professional and technical courses, and the opportunity to specialize in a particular field of recreation.

RECREATION RESOURCES ADMINISTRATION CURRICULUM

The recreation resources administration curriculum fulfills the needs of the graduate who will be employed by federal, state and local government agencies, private enterprises, industry and business, voluntary and quasi-public agencies and other private groups. General education courses are in biology, psychology, history and political science, English, mathematics, chemistry and economics. Specialized courses are in statistics, research methods, computer science, and landscape horticulture. Professional courses, applying directly to the needs of the recreator and his profession, cover recreation philosophy, management techniques and skills, fiscal operation, supervision, comprehensive and site planning, programming, administration, etc.

CONCENTRATIONS

A student may study the application of recreation management to a particular environment by following one of these concentrations:

Commercial Recreation—A background in economics, personnel management, accounting, marketing and business is necessary.

Institutional Recreation—Youth service agencies, corrective institutions and private agencies require that a graduate have emphasis in sociology and psychology.

Urban Park Management—Additional courses in applied biology, horticulture, soils, municipal government and community organization are required.

Natural Resource Recreation Management Requires professional competence in natural resource management where there is a major concern with the preservation, wise use and improvement of recreation resources and opportunities as they occur in the forest environment.

Recreation Planning—A background is required in air photo interpretation, economics, governmental planning and community organization in addition to the core curriculum courses.

Recreation Program Management—A broad knowledge in face-to-face leadership techniques and skills involving the promotion and management of athletics, arts and crafts, music, dramatics and other recreation activities.

Recreation and Park Management Requires the acquisition of a more intensive orientation to both park management and program management. A background in programming, and maintenance and operation is refined.

Interpretive—The management and promotion of interpretive programs requires a background in communications skills, emphasis in the biological sciences, anthropology and history.

RECREATION RESOURCES ADMINISTRATION CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 General Biology	4	EB 201 Economics I or	
ENG 111 Composition & Rhetoric	3	EB 212 Economics of Agriculture	3
RRA 101 Recreation Resources Orientation		ENG 112 Composition & Reading	3
Lab	1	BO 200 Plant Life or	
MA 112 Analytic Geometry &		ZO 201 Animal Life	4
Calculus A or		RRA 241 Recreation Resource Relat.	3
MA 122 Mathematics of Finance	3-4	Social Science-Humanity Elective	3
RRA 152 Introduction to Recreation	3	Physical Education	1
Physical Education	1		17
	15 16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I or		RRA 216 Maintenance & Operations II	3
CH 111 Foundations of Chemistry	4	FOR (WPS) 273 Quantitative Methods	
RRA 215 Maintenance & Operations I	3	in Forest Resources or	
SOC 202 Principles of Sociology or		CSC 200 Introduction to Computers &	
SOC 301 Human Behavior	3	Their Uses	3
SP Elective	3	PS 201 American Govt. Systems or	
Writing Elective	3	PS 206 Local Governmental Systems	3
Physical Education	1	ST 311 Introduction to Statistics	3
	17	*Concentration	3
		Physical Education	1
			16

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BO (ZO) 360 Introduction to Ecology	4	RRA 359 Recreation & Park Supervision	3
RRA 341 Prin. of Recreation Planning	3	RRA 451 Facility & Site Planning	3
RRA 358 The Recreation Program	4	*Concentration	6
Concentration	6	Free Elective	3
	17		15

SUMMER SESSION

(9 weeks)

RRA 475 Recreation and Park Internship	9
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SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
HS 201 Principles of Horticulture or		RRA 454 Recreation & Park Finance	3
HS 342 Landscape Horticulture	3	RRA 491 Spec. Prob. in Recreation or	
RRA 453 Admin. Policies & Procedures	3	SOC 416 Research Methods	3
Social Science-Humanity Elective	3	*Concentration	6
*Concentration	3	Free Elective	3
Free Elective	3		15
	15		
		Hours Required for Graduation	136

Of the 24 hours in the various concentration areas, 9 to 16 hours are required specifically for the selected concentration and 8 to 15 hours are elected from controlled areas.

* Required for Urban Park Management Concentration.

WOOD AND PAPER SCIENCE

Biltmore Hall

Professor R. J. Thomas, Head of the Department

TEACHING AND RESEARCH

Professors: A. C. Barefoot, H. Chang, E. B. Cowling, E. L. Ellwood, I. S. Goldstein, J. S. Gratzl, C. A. Hart, R. G. Hitchings, M. P. Levi, R. G. Pearson; *Adjunct Professors:* L. L. Edwards, P. Koch, W. T. McKean, R. P. Singh; *Professors Emeritus:* R. M. Carter, A. J. Stamm; *Associate Professors:* R. C. Gilmore, A. E. Hassan, M. W. Kelly, H. G. Olf, D. H. J. Steensen; *Visiting Associate Professor:* F. W. Lonsky; *Adjunct Associate Professors:* T. K. Kirk, R. B. Phillips; *Associate Professors Emeritus:* C. G. Landis, C. N. Rogers; *Assistant Professors:* T. V. Gemmer, E. A. Wheeler; *Assistant Professor Emeritus:* H. D. Cook; *Associate Members of the Faculty:* H. B. Moore (Entomology), A. Prak (Industrial Engineering), V. T. Stan nett (Chemical Engineering).

EXTENSION

Professor: M. P. Levi, *Leader, Wood Products Section, Associate Professor Emeritus:* L. H. Hobbs; *Assistant Professor:* S. J. Hanover. *Specialists:* R. C. Allison, E. L. Deal, L. G. Jahn

The wood industries have been a vital part of North Carolina's economy for over 300 years. North Carolina ranks high in the manufacture of hardwood, plywood, and wooden furniture, rough lumber and railroad tie production and the manufacture of pulp and paper. The value of forest products produced annually in the state exceeds three billion dollars. Seventeen percent of the state's labor force is employed in the wood industries.

The Department of Wood and Paper Science offers two curricula leading to Bachelor of Science degrees—wood science and technology and pulp and paper science and technology—to educate persons for careers in the wood based and allied industries or in government agencies concerned with wood resources. Wood science and technology is concerned with the technical aspects of wood and its processing into reconstituted and manufactured products. Pulp and paper science and technology deals specifically with wood fibers and their processing for paper and wood based chemicals.

PULP AND PAPER SCIENCE AND TECHNOLOGY

Robertson Laboratory

Professor R. G. Hitchings, In Charge

This curriculum prepares people for technical work in the rapidly growing pulp and paper industry which ranks fifth among all American industries. This is primarily a Southern industry with over 60 percent of the nation's pulpwood produced in the South. Careers include process engineers, product development engineers, technical service engineers, quality control supervisors, process control chemists and production supervisors. After basic science courses, the students study in the specialized Robertson Pulp and Paper Laboratory wood pulp processes, chemical and by-products recovery, pulp bleaching, and in the various paper-making operations, such as refining, sizing, filling, dyeing, formation, coating and the converting of paper.

Pulp and paper is a regional program approved by the Southern Regional Education Board as the undergraduate program to serve the Southeast in this field. Approximately 70 undergraduate scholarships are granted annually to students by more than 100 company members composing the Pulp and Paper Foundation.

All pulp and paper majors spend at least one summer working in a pulp or paper mill designated by the University. One hour of academic credit is granted after completion of 12 weeks of mill work and presentation of a satisfactory report. In addition to this minimum summer work requirement, students are urged to work in mills the two other summers between academic years to gain valuable practical experience.

This curriculum leads to a Bachelor of Science in pulp and paper science and technology. Three programs are available emphasizing the technological, engineering or scientific aspects of pulping and papermaking. The technology program provides a broad background for those students anticipating careers in mill operations or with paper industry supplier

organizations. Greater depth in the underlying scientific principles or their applications can be obtained from the science and engineering programs, which also provide a good foundation for graduate study. A fifth year program leading to a second degree, a Bachelor of Science in chemical engineering, is available.

PULP AND PAPER SCIENCE AND TECHNOLOGY CURRICULA

TECHNOLOGY PROGRAM

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
ENG 111 Composition and Rhetoric	3	ENG 112 Composition & Reading	3
MA 112 Analytic Geometry & Calculus A*	4	WPS 242 Wood Fiber Analysis	3
WPS 101 Intro. to Wood and Paper Science	1	MA 212 Analytical Geometry & Calculus B*	3
Social Science Humanity Elective**	3	E 101 Engineering Graphics I	2
Physical Education	1	Physical Education	1
	16		16

* Honors students take MA 102, 201 and 202

** Basic economics course recommended

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 220 Introductory Organic Chemistry	4	CH 315 Quantitative Analysis	4
PY 211 General Physics*	4	PY 212 General Physics*	4
ST 361 Introduction to Statistics for Engineers	3	WPS (FOR) 273 Quantitative Methods in Forest Resources	3
Physical Education	1	Social Science Humanity Elective	3
Social Science-Humanity Elective	3	Physical Education	1
Free Elective	3		15
	18		

* Honors students take PY 205, 205

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 331 Introductory Physical Chemistry	4	Engineering Elective*	3
CHE 301 Elements of Chemical Engineering	3	CHE 302 Elements of Chemical Engineering	3
WPS 211 Pulp & Paper Internship	1	WPS 322 Pulp & Paper Technology II	3
WPS 321 Pulp & Paper Technology I	3	WPS 332 Wood & Pulp Chemistry	4
WPS 331 Introduction to Wood and Pulp Chemistry	1	Free Elective	2
MAE 307 Energy & Energy Transformations	3		16
Social Science-Humanity Elective	3		
	18		

* EE 331, 350, IE 901 or CHE 225

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
WPS 471 Pulp/Process Analysis	3	WPS 403 Paper Process Analysis	3
WPS 411 Pulp/Paper Unit Processes I	3	WPS 412 Pulp & Paper Unit Processes II	3
WPS 491 Senior Problems in Wood & Paper Science	1	WPS 463 Plant Inspections	1
Social Science Humanity Elective	3	Social Science-Humanity Elective	3
WPS 412 Paper Properties & Additives	3	Free Elective	3
Technical Elective	3	Technical Elective	3
	16		16
		Hours Required for Graduation	131

SCIENCE PROGRAM

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
CH 101 General Chemistry I	4	CH 107 Principles of Chemistry	4
MA 102 Analytic Geometry & Calculus I	4	MA 201 Analytic Geometry & Calculus II	4
WPS 101 Intro. to Wood and Paper Science	1	E 101 Engineering Graphics I	2
Social Science-Humanity Elective*	3	WPS 242 Wood Fiber Analysis	3
Physical Education	1	Physical Education	1
	16		17

* Basic economics course recommended

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 221 Organic Chemistry I	4	CH 223 Organic Chemistry II	4
MA 202 Analytic Geometry & Calculus III	4	MA 301 Applied Differential Equations I	3
PY 205 General Physics	4	PY 208 General Physics	4
Social Science-Humanity Elective	3	Free Elective	3
Physical Education	1	Physical Education	1
	16		15

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 431 Physical Chemistry I	3	CH 433 Physical Chemistry II	3
CH 432 Physical Chemistry I Laboratory	1	WPS 322 Pulp and Paper Technology II	3
WPS 211 Pulp and Paper Internship	1	WPS 332 Wood & Pulp Chemistry	4
WPS 321 Pulp and Paper Technology I	3	Social Science-Humanity Elective	3
ST 361 Introduction to Statistics for Engineers	3	Technical Electives	4
CH 315 Quantitative Analysis	4		17
Free Elective	3		
	18		

SENIOR YEAR

<i>Full 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 491 Senior Problems in Wood & Paper Science	1	WPS 463 Plant Inspections	1
WPS 413 Paper Properties and Additives	3	Free Elective	3
Social Science-Humanity Electives	6	Social Science-Humanity Elective	3
Technical Elective	3	Technical Electives	6
	16		16
		Hours Required for Graduation	131

CHEMICAL ENGINEERING PROGRAM (Pulp and Paper Science and Technology Curriculum)

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 112H Composition and Reading*	3	E 101 Engineering Graphics I	2
CH 101 General Chemistry I	4	CH 107 Principles of Chemistry	4
WPS 101 Intro. to Wood and Paper Science	1	WPS 242 Wood Fiber Analysis	3
MA 102 Analytic Geometry & Calculus I	4	MA 201 Analytic Geometry & Calculus II	4
Social Science-Humanity Elective	3	Social Science-Humanity Elective	3
Physical Education	1	Physical Education	1
	16		17

* If not qualified, take ENG 111 and 112.

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 205 General Physics	4	MA 301 Applied Differential Equations I	3
MA 202 Analytic Geometry & Calculus III	4	CHE 225 Chemical Process Systems	4
CHE 205 Chemical Process Principles	4	PY 208 General Physics	4
Physical Education	1	Social Science-Humanity Elective (ENG)	3
	17		18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
WPS 211 Pulp & Paper Internship	1	WPS 322 Pulp & Paper Technology II	3
WPS 321 Pulp & Paper Technology I	3	CHE 327 Separation Processes I	3
CHE 315 Chemical Process Thermo- dynamics	3	CHE 316 Thermodynamics of Chemical and Phase Equivalent	3
MAT 201 Structure & Properties of Engineering Materials	3	CH 495 Special Topics in Physical Chemistry	3
CHE 311 Transport Processes I	3	WPS 332 Wood and Pulping Chemistry	4
Social Science-Humanity Elective	3		16
Physical Education	1		
	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 411 Pulp & Paper Unit Processes I	3	WPS 412 Pulp & Paper Unit Processes II	3
WPS 491 Senior Problems in Wood & Paper Science	1	WPS 463 Plant Inspections	1
WPS 413 Paper Properties and Additives	3	Social Science-Humanity Elective	2
Social Science-Humanity Elective	3	EE 331 Principles of Electrical Engineering	3
CHE 330 Chemical Engineering Labora- tory I	2		13
CHE 446 Chemical Process Kinetics	3		
	18	Hours Required for Graduation	132

WOOD SCIENCE AND TECHNOLOGY

Associate Professor W. M. Kelly, In Charge

Wood science and technology is an applied science of an interdisciplinary nature utilizing the natural sciences, mathematics, engineering and economics to understand wood and its processing. It is a materials science, but also involves industrial manufacturing and management. A wood technologist performs many engineering oriented functions; but, unlike the engineer, he has a thorough knowledge of wood as a raw material. This knowledge is essential to the proper application of engineering concepts to the processing of wood.

OPPORTUNITIES

The wood technologist's scientific engineering, industrial knowledge and specialty in the properties and behavior of wood qualify him or her for positions in today's modern wood manufacturing industries.

Careers include industrial positions with both large and small companies manufacturing lumber, veneer, plywood, particle and fiber boards and consumer wood products such as furniture. Wood technologists are also in demand by suppliers to wood manufacturing industries, such as chemical and machinery companies. Policy making opportunities are available with state and federal government in research, marketing or extension activities.

The importance of wood as a raw material is greater today than ever before. Because of diminishing supplies of non-renewable resources, increased costs of their procurement, and the high energy consumption required to convert them into finished products, wood, as a renewable resource, is an attractive alternative. Accordingly the increase in the variety of wood products which will be in demand promises a bright future for the wood-using industries and will substantially increase career opportunities for wood scientists, wood technologists and wood industry managers.

FIELDS OF SPECIALIZATION

The program provides the opportunity to follow concentrations in a discipline outside the department to the extent of a minimum of 18 credit hours. The student may develop a second area of concentration which can be applied to the field of wood science and technology and which can also provide a base for subsequent graduate work in wood science and technology or in the concentration. Concentrations are available in: a) business, b) quantitative analysis, c) biology and bio-chemistry, d) chemistry, e) harvesting operations, f) industrial engineering and g) furniture manufacturing. Concentrations other than those listed may be arranged.

DUAL DEGREE PROGRAM

A dual degree program is available with the Department of Economics and Business whereby students can obtain, in addition to a Bachelor of Science in wood science and technology, a second Bachelor of Science in economics.

Additional credits beyond those required for the single degree program are necessary. Capable students can usually obtain additional credits within the four years of the regular undergraduate program.

CURRICULUM

The Wood Science and Technology curriculum at North Carolina State University is designed to prepare the graduate for production supervision, staff positions and management responsibilities in all types and sizes of wood industries. It also provides numerous credits in elective courses. These electives give the student an opportunity to specialize in science courses as a wood scientist, in engineering courses as a wood engineer, in business, economics and administration as a manager, or in other concentration areas.

If desired, course selection also provides concentration for specific industries such as veneer and plywood, furniture and home furnishings, architectural woodwork and fixtures, lumber and dimension parts, composite boards and treated products, and such allied industries as adhesives, coatings and machinery.

At the end of the sophomore year, students attend a six-weeks wood products practicum in the Brandon P. Hodges Wood Products Laboratory. From drawings and bills of materials, they process a cutting order from lumber to the finished nightstand. They set up and operate all machines, make particleboard and plywood, test glued joints for strength, and apply the finish to the nightstand.

Following the practicum, students undertake an internship in wood or allied industries and gain valuable practical industrial experience. Both the practicum and the work experience enhance the student's understanding of the business aspects and the production phase of a wood industry.

WOOD SCIENCE AND TECHNOLOGY CURRICULUM

FRESHMAN YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chem I	4	BS 100 General Biol. or	
ENG 111 Composition & Rhetoric	3	BO 200 Plant Life	4
WPS 101 Intro to WPS	1	CH 103 General Chem II	4
MA 112 Anal. Geom. & Calc. A*	4	ENG 112 Composition & Reading	3
Physical Education	1	MA 212 Anal. Geo. & Calc. B*	3
SS & H Elective**	3	Physical Education	1
	16		15
SOPHOMORE YEAR			
<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
EB 201 or EB 212 Economics	3	WPS 203 Wood Struct. & Prop II	3
PY 221 College Physics	5	WPS 230 Wood Protection	3
WPS 202 Wood Struct. & Prop I	3	Free Elective	3
Physical Education	1	Physical Education	1
S & H Elective**	3	SS & H Electives**	6
	15		17

SUMMER PRACTICUM

WPS 205 Wood Products Practicum	5
WPS 210 Forest Products Internship	1
	<hr/> 6

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ST 361 Statistics for Eng.	3	WPS 302 Wood Processing II	3
WPS 301 Wood Processing I	3	WPS 316 Wood-Polymer Princ.	3
WPS 315 Intro. to Wood-Polymer Principles	2	WPS 344 Intro. to Qual. Control	3
ENG 321 Commun. Tech. Inform.	3	WPS 350 Wood Technology Literature	1
Concentration Elective	3	Concentration Electives	6
	<hr/> 14		<hr/> 16

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
WPS 434 Wood Operations	3	WPS 442 Wood Mechanics & Design	3
WPS 441 Intro. to Wood Mechanics	3	WPS 450 Wood Industry Case Studies	2
WPS 491 Senior Problems	2	Concentration Elective	3
Concentration Electives	6	Free Electives	6
SS & H Elective**	3		14
	<hr/> 17	Hours Required for Graduation	130

* Students with appropriate mathematical aptitude and interest are encouraged to substitute MA 102, MA 201 and MA 202 for the mathematical sequence listed.

** Should be distributed approximately equally between traditional humanities courses and social science courses.



As a major national research university, NCSU has large scale research responsibilities. The annual operating level is about \$25 million.

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

R. O. Tilman, *Dean*

W. B. Toole III, *Associate Dean*

The School 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.

Nine departments are included in the School of Humanities and Social Sciences: economics and business (also a department in the School of Agriculture and Life Sciences), English, history, foreign languages and literatures, philosophy and religion, physical education, political science, sociology and anthropology (also a department in the School of Agriculture and Life Sciences) and speech-communication. Undergraduate majors are offered in economics, accounting, business management, English, history, French, Spanish, philosophy, political science, sociology, social work, speech-communication, and multi-disciplinary studies. In some departments special concentrations are available within the major programs: e.g., writing and editing (English), and criminal justice (political science or sociology). A teacher education option is available in English, French, Spanish, and social studies (history, economics, political science, sociology). Degrees granted include the Bachelor of Arts, the Bachelor of Science, the Master of Arts, and the Doctor of Philosophy, as well as professional degrees in economics, political science, and sociology.

BACHELOR OF ARTS PROGRAM

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
History*	3	History	3
Mathematics**	3-4	Mathematics	3-4
Foreign Language 201 (Intermediate)***	3	Philosophy****	3
Social Science***	3	Social Science	3
Physical Education	1	Physical Education	1
	16-17		16-17

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Literature*****	3	Literature	3
Natural Science*****	3-4	Natural Science	3-4
Elective	3	Social Science	3
Social Science	3	Elective	3
Elective	3	Area Elective*****	3
Physical Education	1	Physical Education	1
	16-17		16-17

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Major*****	6	Major	6
Electives	9	Electives	6
	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
	15		15

Hours Required for Graduation124

- * A two semester program including 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 206, 210, 221, 222, 233, 241, 242, 243, 244)
- ** Two semesters required for economics and business or sociology majors (MA 112, 113, or 102 and 114 required for economics and business; MA 111 112 recommended for sociology but any two mathematics courses other than MA 115 allowed). For all other humanities and social science majors the requirement may be satisfied with any two mathematics courses other than MA 115 or one course other than MA 115 plus a course in computer science, statistics, or logic.
- *** Proficiency required at the first-semester intermediate level in French, Spanish, German, Russian, Italian, Latin, Greek, Biblical Hebrew, or Portuguese. Proficiency at the second semester intermediate level in one of these languages is required for English, speech communication, 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.
- ***** Three hours of philosophy, exclusive of logic (PHI 201 and 335), are required
- ***** This requirement calls for any two of the following survey courses in British literature, American literature, and foreign language literature: ENG 261, ENG 262, ENG 265, ENG 266, FLG 301, FLG 302, FLS 301, FLS 302, FLF 301, FLF 302, FLS 303, FLS 304
- ***** This requirement calls for a minimum of eight credit hours including one basic introductory course from physics, chemistry, or the biological sciences [CH 101, CH 103, CH 105, (with CH 104 lab), CH 107, CH 111; PY 205, PY 206, PY 211, PY 212, PY 221, PY 231, PY 232, BS 100 or BS 105, BO 200]. The following guidelines should be applied in the selection of the course or courses needed to complete the requirement: Any of the above-listed courses with the exception of BS 100 or BS 105 if the student has received credit for either of these courses; any biology course; any botany course; any chemistry course; any entomology course; any geology course; any genetics course; any marine science course; any meteorology course; NTR (ANS, FS); PE 285 (Personal Health); any physics course; any zoology course.
- ***** One of the following courses outside the student's major is required: DN 141, DN 142, DN 441; ENG (REL) 325, ENG 346, ENG 347, ENG 390; FCL 300, FCL 310; FLF 251, FLF 257, FLF 350, FLF 352, FLF 492; FLG 254, FLG 256; FLR 303, FLR 304; FLS 252, FLS 256, FLS 495; GRK 310, GRK 320; HA 201, HA 202, HA 203, HA 298; HSS 298; MUS 290, MUS 210, MUS 215, MUS 220, MUS 301, MUS 320; any religion course except Hebrew language courses; SP 103, SP 213, SP 221, SP 331, SP 401.
- ***** Major requirements for the Bachelor of Arts range from 30-42 hours. Most of the major programs call for 30 hours of work above the basic courses in a discipline.

BACHELOR OF SCIENCE PROGRAM

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	
ENG 111 Composition & Rhetoric	3	or	
Mathematics*	4	CH 103 General Chemistry II	4
Physical Education	1	ENG 112 Composition & Reading	3
Humanities/Social Science Elective**	3	Mathematics	3-4
	15	Physical Education	1
		Humanities/Social Science Elective	3
			14-15

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PHI 205 Problems & Types of Philosophy	3	Humanities/Social Science Elective	3
Mathematics	3-4	Course I Major****	3
PY 205 or 211 General Physics	4	Mathematics	3
Physical Education	1	PY 208 or 212 General Physics	4
Foreign Language/English Literature***	3	Physical Education	1
	14 15	Foreign Languages/English Literature	3
			17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BS 100 General Biology	4	Humanities Social Science Elective	3
History or Philosophy of Science*****	3	Course IV Major	3
Course II Major	3	Course V Major	3
Course III Major	3	Advanced Technology or Science	
Advanced Technology or Science		Course II	3 4
Course I*****	3 4	Zoology 201 General Zoology or	
	16 17	Botany 200 Plant Life	4
			16-17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Course VI Major	3	Course VIII Major	3
Course VII Major	3	Course IX Seminar in Major	3
Advanced Technology or Science Course II	3 4	Advanced Technology or Science	
Electives	6	Course IV	3-4
	15 16	Electives	6
			15 16

Total Hours Required for Graduation :127

- * One of the following four-course sequences: 1) MA 102, 201, 202 and 301, 312, 405; 2) MA 112, 212, 114, 214
- ** Twelve hours in humanities and/or social sciences in areas outside major discipline.
- *** Six hours of foreign language and/or English literature at 200 level or above
- **** Twenty-seven hours are required in economics, English, history, philosophy, or political science.
- ***** One of the following: HI 322, HI 321, HI 341, or MA 493.
- ***** A 15-hour concentration is required in some area of science or technology

COOPERATIVE EDUCATION IN THE B.A. AND B.S. PROGRAMS

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 W. D. Weston (116 Tompkins Hall).

JOINT HUMANITIES AND SOCIAL SCIENCES- ENGINEERING PROGRAM

Some students may want to combine a Bachelor of Science in engineering with either a Bachelor of Science or Bachelor of Arts in Humanities and Social Sciences. When the two are carried along together, the double degree program can be completed in five years. Those interested should contact the Director of the Freshman Engineering Division and the Associate Dean of Humanities and Social Sciences.

ECONOMICS AND BUSINESS

Patterson Hall

Professor W. D. Toussaint, Head of the Department

Professor D. M. Hoover, Assistant Head for Graduate Programs

Professor B. M. Olsen, Assistant Head and Coordinator for Advising

Professor R. C. Wells, Assistant Head, In Charge of Extension

TEACHING, RESEARCH AND EXTENSION

Professors R C Brooks, G A Carlson, A J Couto, R D Dahle, E W Erickson, R M Fearn, D G Harwood, L A Ihnen, P R Johnson, Thomas Johnson, C P Jones, E W Jones, R A King, H L Limer, T E Nichols Jr., E C Pasour Jr., R J Pfeiler Jr., R K Perrin, E A Proctor, C R Pugh, R A Schrimper, J A Seagraves, R L Simmons, R E Sylla, C B Turner, W L Turner, C R Weathers, J C Williamsen Jr., *Visiting Professor* Douglas Fisher, *Professors Emeriti* A. J. Bartles, D R Dixon, J G Sutherland (USDA), E W Swanson, *Associate Professors* J. G. Allgood, D. S. Ball, J. S. Chap pell, L E Danulson, J E Easterly Jr., M M El Kammash, A R Gallant, H C Gilliam Jr. (USDA), T J Greenes, C W Harre J Jr., D M Holthausen, D N Hyman, M A Johnson, J S Lapp, M B McElroy, C J Messere, D F Neuman, C J Ponderster Jr., D D Robinson, P S Stone, J W Wilson, *Associate Professors Emeriti* R S Boal, H A Homme, *Assistant Professors* S G Allen, G A Benson, R L Clark, D B Diamond, D J Flath, J D Hanson, C R Knoeber, E W Leonard, M P Loebe, D E Morris (USDA), L B Perkinson USDA, W P Pinna, J S Royer, G M Scoble, D A Sumner, G F Voecke, M L Walden, W J Wessels, M K Wohlgemant, *Assistant Professors Emeriti* J C Matthews Jr., E M Stallings, G G Thompson, *Instructors* W P Brown, Mary R Hilliard, T M Reynolds, *Lecturers* A M Beals Jr., C Lynn Bergold, C E Bowen, J. P. Huggard, Judith M. Jeffreys, Susan W Johnson, M P Windham, *Editors on Specialties* C E Hammond, S C Riddick, S R Sutter, *Associate Members of the Faculty* R H Bernhard Industrial Engineering, D L Holley Forestry.

The economics and business program develops in the student critical and analytical skills which underlie the ability to understand contemporary problems and institutions, both in their historical setting and under conditions of change. The curriculum furnishes the academic background necessary for positions in industry, government service and graduate work (see listing of graduate degrees offered and consult the Graduate Catalog) in economics, business and the social sciences.

The Department of Economics and Business offers degrees in several undergraduate fields of study. These include the Bachelor of Arts degrees in accounting, business management, economics and the Bachelor of Science degree in economics. In addition, the department offers the social studies teacher education option to prepare the student for "A" certification in North Carolina secondary schools.

The department is administered jointly by the Schools of Agriculture and Life Sciences and Humanities and Social Sciences. See agricultural economics under School of Agriculture and Life Sciences for information on that program.

The department also provides service courses for the various technical schools and the Division of Continuing Education. An increasing number of curricula now offer a minor program in economics or business.

The department maintains a library including technical reference books, major professional journals and government publications. Research publications from other institutions throughout the United States are on file. Computational facilities are available for students whose research problems involve extensive analysis of data, as well as for those students who want to learn to use computer facilities. The department has a specially-trained clerical and programming staff and has access to an IBM System/370 Model 165 operated by the Triangle University Computational Center. Access is also available to other medium speed terminals and an IBM System/360 Model 40 located on the University campus.

BACHELOR OF ARTS IN ECONOMICS

The Bachelor of Arts degree in economics consists of 15 hours in prescribed courses and 15 hours elected from a restricted list of societally-oriented courses. Another 15 hours must be selected with an adviser's approval.

	<i>Credits</i>		<i>Credits</i>
EB 302 Economics II	3	EB 490 Senior Seminar in Economics	3
EB 401 Production and Prices	3	Restricted electives in Economics	15
EB 302 Aggregate Economic Analysis Theory and Policy	3	Electives approved by an adviser	15
EB 350 Economics and Business Statistics*	3		45
		Total hours for graduation	124

BACHELOR OF ARTS IN ACCOUNTING

The Bachelor of Arts degree in accounting consists of 36 hours in prescribed courses of which 21 hours are accounting courses. Six hours may be chosen from a restricted list of societally-oriented economics courses, and 9 hours must be selected with an adviser's approval unless ACC 468 is chosen in place of EB 490. In the latter case the number of approved elective hours will be 12.

	<i>Credits</i>		<i>Credits</i>
EB 202 Economics II	3	ACC 468 Professional Accountancy Resume	3
EB 301 Production and Prices	3	Restricted electives in economics	6
EB 302 Aggregate Economic Analysis Theory and Policy	3	Accounting concentration	21
EB 350 Economics and Business Statistics*	3	Electives approved by an adviser	12
			54
		Total hours for graduation	124

BACHELOR OF ARTS IN BUSINESS MANAGEMENT

The Bachelor of Arts degree in business management consists of 51 hours of prescribed and elected courses. Of these, 21 hours are required as the core. The remainder of the hours are elected from 6 hours of courses from a restricted list, 9 hours from three of the five areas of business concentration, and 15 hours elected with an adviser's approval.

	<i>Credits</i>		<i>Credits</i>
ACC 260 Accounting I	3	EB 350 Economics and Business Statistics*	3
EB 202 Economics II	3	EB 307 Business Law I	3
EB 301 Production and Prices	3	EB 490 Senior Seminar in Economics	3
EB 302 Aggregate Economic Analysis Theory and Policy	3	Restricted electives in Economics	6
		Electives from Areas of Business Concentration	9
		Electives approved by an adviser	15
			51
		Total hours for graduation	124

* ST 311, 361 or 371-372 may be substituted for EB 350, but only one of these courses may be used to earn credit for graduation.

SOCIAL STUDIES TEACHER EDUCATION OPTION

The Bachelor of Arts degree with a major in economics, social studies teacher education option, consists of a modified economics major plus 24 hours of complementary courses in history, sociology, anthropology and political science. Additional courses in psychology and education (including student teaching) in the 129 hour program complete the requirements for "A" certification. The social studies teacher education program is open to majors in economics, history, political science, and sociology and anthropology. Admission to the program, however, is limited to approximately 15 students per semester. Applicants are selected on the basis of academic competition and dedication to teaching.

	<i>Credits</i>		<i>Credits</i>
EB 301 Production and Prices	3	Restricted Electives in Economics	15
EB 302 Aggregate Economic Analysis Theory and Policy	3	Total Economics Courses	24
EB 350 Economics and Business Statistics*	3	Complementary Courses in History and Social Sciences	24

* ST 311, 361, or 371-372 may be substituted for EB 350, but only one of these courses may be used to earn credit for graduation.

BACHELOR OF SCIENCE DEGREE

The Bachelor of Science degree with a major in economics consists of 27 hours in prescribed and elected courses. Of these, 15 or 18 hours are required as the core. Nine of the remaining hours must consist of economics electives.

	<i>Credits</i>
EB 201 Economics I	3
EB 202 Economics II*	3
EB 301 Production and Prices	3
EB 302 Aggregate Economic Analysis Theory and Policy	3
<i>Credits</i>	
EB 350 Economics and Business Statistics**	3
EB 490 Senior Seminar in Economics	3
Restricted Electives in Economics	6
EB Elective	3
	27

* EB 202 may be waived subject to the approval of the student's faculty adviser

** ST 311, 361 or ST 372 may be substituted for EB 350, but only one of these courses may be used to earn credit for graduation

ELECTIVE COURSES

Students must complete at least two courses selected from the specified list of economics electives, the two intermediate theory courses (EB 301 and EB 302) and one of the basic statistics courses before enrolling in Senior Seminar (EB 490 or ACC 468).

These electives, primarily society oriented are: EB 304, EB 370 (HI 370), EB 371 (HI 371), EB 404, 410, 413, 422, 430, 431, 435, 436, 442, 448, 448, 451, 475, 501, 502, 515, 521, 533, 540, 550, 551, 555, 561 (ST 561), 570, and 574 (SOC 574).

Additional firm-oriented economics electives are available. These courses are often considered business courses and are intended to provide skills for dealing with problems at firm level. These areas of business concentration are:

Finance: EB 404, 415, 420
Business Management: EB 410, 526, 535
Marketing: EB 311, 313, 430, 521
Personnel: EB 326, 332, 431
Production: EB 303, 325, 523, 551

Courses from other departments may be used to fulfill business concentration requirements upon approval of the Department of Economics and Business.

ENGLISH

Winston Hall

Professor L. S. Champion, Head of the Department

Professor R. B. White Jr., Assistant Head of the Department

Professor P. E. Blank, Coordinator of Advising

Professors: L. S. Champion, J. D. Durant, M. Halperen, A. S. Knowles, E. G. Koonce Jr., W. E. Meyers, F. H. Moore Jr., G. Owen Jr., M. S. Reynolds, W. B. Toole III, R. B. White Jr., M. C. Williams, P. Williams Jr., *Professors Emeriti:* L. C. Hartley, H. G. Kincheloe, R. G. Walser, *Associate Professors:* B. J. Haines, L. J. Betts Jr., P. E. Blank Jr., E. D. Clark, J. W. Clark Jr., E. P. Dandridge Jr., J. B. Easley, H. A. Hargrave, M. T. Hester, L. F. Jeffers, D. L. Laryea, C. E. Moore, D. D. Short, N. G. Smith, J. J. Smsot, A. P. Stain, T. N. Walters, H. C. West, *Assistant Professors:* J. S. Anhorn, M. M. Brandt, V. C. Downs, E. D. Engel, J. M. Grimwood, A. H. Harrison, W. E. Haskin, L. T. Holley, R. W. Kelton, J. A. Kilby Jr., M. F. King, V. B. Lentz, L. H. Mackethan, C. A. Prioli, N. B. Rich, L. S. Rudner, K. L. Seidel, J. N. Wall Jr., R. V. Young Jr., *Instructors:* G. W. Barras, D. H. Covington, C. R. Horner, C. R. Miller; *Lecturers:* G. B. Blank, A. E. Brown, R. M. Butler, P. R. Cockshutt Jr., J. S. Griffin, J. H. Hobbs, S. B. Jordan, A. H. McDonald, A. F. Mann, G. L. Stephenson, L. H. Stribling, F. M. Viverette, J. P. Williams; *Visiting Lecturers:* L. B. Davies, F. A. Smith; *Part-Time Lecturer:* D. E. Walls; *Visiting Part-Time Lecturers:* H. G. Seolnicov, D. Ketchiff, *Preceptor in Transition Program:* L. J. Woolton

The Department of English offers basic and advanced courses in composition, language, and literature. The freshman courses, common to all curricula and prerequisite to all advanced courses in English, are designed to give intensive training and practice in written communication, in addition to an introduction to literary types. Courses in communication of technical information and in creative and advanced expository writing are offered to meet requirements in special curricula and to provide elective credits. Advanced courses are available for a major in literature (Bachelor of Arts program), majors in English—writing and editing option (Bachelor of Arts program) or teacher certification option (Bachelor of Arts program), and a concentration in literature (Bachelor of Science program), as well as for general electives.

See listing of graduate degrees offered.

B.A. PROGRAM, MAJORS IN ENGLISH

Bachelor of Arts Degree Program The student must schedule 36 semester hours beyond the usual six hours in freshman composition. Basic requirements include the sophomore survey of English literature, a course in Shakespeare, and at least one course in American writers. Beyond these courses, the student may pursue special interests within the limits of two recommended categories.

Bachelor of Arts in English—Writing and Editing Option—The student must schedule 36 semester hours beyond the usual six hours in freshman composition. Courses are included in journalism, copyediting, technical writing, public speaking, and literature. In the final semester, a special seminar (ENG 498) will serve as a capstone to one's study. Additionally the student must schedule 15-18 semester hours in a track or discipline in which one wishes to apply communication skills.

Bachelor of Arts in English—Teacher Education Option

English majors may enroll in the teacher education option offered by the School of Humanities and Social Sciences in cooperation with the School of Education. Students who complete this program are eligible to apply for certification to teach English in secondary schools in North Carolina. The requirements of the program include 28 semester hours in professional courses and 36 semester hours in English beyond the usual six hours in freshman composition. (Total 124 credit hours required for graduation.) Students desiring to enter this program should declare their intention before the spring of the sophomore year and are required to file a formal application for admission which must be approved in order for them to participate.

B.S. PROGRAM, CONCENTRATION IN ENGLISH

Bachelor of Science Program—The student, in consultation with his or her department adviser, must schedule 27 semester hours beyond the usual six hours in freshman composition.

FOREIGN LANGUAGE AND LITERATURES

1911 Building

Professor A. A. Gonzalez, Head of the Department

Associate Professor S. E. Simonsen, Assistant Head of the Department and Coordinator of Advising

Professor: E. M. Stack; Professor Emeritus: G. W. Poland; Associate Professors: T. P. Feeny, G. Gonzalez, J. R. Kelley, M. Paschal, E. W. Rollins, G. G. Smith, J. H. Stewart II, Tucker Jr.; Assistant Professor Emeritus: F. J. Allred; Assistant Professors: R. A. Alder, S. T. Alonso, L. L. Cofresi, L. A. Dahlin, T. N. Hammond, W. M. Hollier, E. D. Myers, V. M. Prichard, C. E. Sorum, M. A. Witt; Assistant Professor Emerita: R. B. Hall; Instructors: C. Elkabas, S. Gulack, A. C. Malinowski; Lecturer: E. Jazierski

MAJORS IN FRENCH OR SPANISH

All the general requirements for the Bachelor of Arts degree must be met, including six hours of literature survey outside the major field. Degree designations are: B.A. in French Language and Literature, B.A. in Spanish Language and Literature, French Language and Literature Teacher Education option and Spanish Language and Literature Teacher Education option.

Bachelor of Arts degree Students must complete 36 hours beyond the elementary courses (101-102), including a senior seminar. Majors must take 12 additional hours of related studies.

B.A. Program with Teacher Education Option—In collaboration with the School of Education, the department offers a program upon completion of which graduates may be certified as secondary school foreign language teachers in the North Carolina public school system. (Total 127 credit hours required for graduation.) Candidates should advise their academic counsellor as early as possible for the proper planning of their curriculum. They should formally declare their intention by the spring semester of the sophomore year.

No graduate degrees are given in foreign languages, but special courses and certification examinations are offered for advanced degree students.

HISTORY

Harrelson Hall

Associate Professor M. E. Wheeler, *Head of the Department*

Associate Professor R. N. Elliott, *Assistant Head of the Department*

Professor J. P. Hobbs, *Coordinator of Advising*

Professors B. F. Bevis, M. L. Brown Jr., M. S. Downs, R. W. Greenlaw, W. C. Harris, J. P. Hobbs, D. E. King, J. M. Riddle, S. Surval, B. W. Walsh, *Professor Emeritus* L. W. Seegers; *Associate Professors* J. R. Banker, W. H. Beezley, C. H. Carlin, R. N. Elliott, G. D. Newby, R. H. Sack, D. M. Scott, E. D. Sylla, M. E. Wheeler, *Associate Professor Emeritus* L. W. Barnhardt; *Adjunct Associate Professors* T. W. Mitchell; *Assistant Professors* R. M. Collins, C. J. Constantine, J. E. Crisp, N. B. Kitchiff, A. J. LaVapa, J. A. Millholland, G. W. O'Brien, J. K. Oeko, K. P. Vickery; *Adjunct Assistant Professors* W. S. Price Jr.

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 wide range of introductory courses is available to satisfy the history requirement or part of the humanities and social sciences requirements in most University curricula. Students in the School of Humanities and Social Sciences are required to take two courses in history: one dealing with a culture significantly different from our own in preindustrial Western or non-Western societies and the other dealing with our own culture in the United States or post-industrial Western societies.

Some introductory and advanced courses and most graduate courses are offered in the evening. See listing of graduate degrees offered.

BACHELOR OF ARTS DEGREE PROGRAM

A history major must take 30 hours of course work in history in addition to the six hours required of all students in the School of Humanities and Social Sciences. These 30 hours must include a senior seminar. At least 24 hours of the 30 must be at the 400 level or above.

Bachelor of Arts Program with Teacher Education Option

History majors may enroll in the teacher education program offered by the School of Humanities and Social Sciences in cooperation with the School of Education. Students who complete this program are eligible for certification for teaching social studies in secondary

schools in North Carolina. In addition to Bachelor of Arts degree requirements, students are required to take professional courses in education and psychology and additional social sciences courses (130 credit hours required for graduation). Students desiring to enter this program should declare their intention during their sophomore year. They are required to file an application for formal admission during their junior year. Admission is competitive and the criteria include an overall grade point average of 2.5 or better.

BACHELOR OF SCIENCE DEGREE PROGRAM

A concentration in history involves 18 hours of course work beyond the six hours required of all students in the School of Humanities and Social Sciences plus a senior seminar. Of the 18 hours, at least 12 must be at the 300 level or above.

MULTI-DISCIPLINARY STUDIES

Multi-Disciplinary Studies Committee

Professor R. S. Bryan (Philosophy and Religion), Chairman

Professor W. B. Toole (English)

Associate Professor W. C. Harris (History)

Associate Professor M. M. Sawhney (Sociology and Anthropology)

Associate Professor J. W. Wilson (Economics and Business)

Professor Paul A. Bredenburg and Associate Professor W. Curtis Fitzgerald, Coordinators of Advising.

The multi-disciplinary 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 of specialization from *two or more* disciplines. A concentration in Latin American studies might, for example, combine related courses in language, literature, history, economics, sociology and political science.

The freshman and sophomore basic requirements for the multi-disciplinary 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 multi-disciplinary studies, a student first secures application forms and information from the office of the dean of the School of Humanities and Social Sciences (Tompkins Hall, Room 118) or from the office of the chairman of the Multi-Disciplinary Studies Committee (Harrelson Hall, Room 361), then prepares a tentative proposal which includes a list of courses comprising 30 credit hours and an essay of 300-500 words explaining one's 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 Multi-Disciplinary Committee for consideration. After a thorough examination to determine whether the set of courses proposed as a multi-disciplinary major is academically sound and coherent, the committee will recommend that the Dean of Humanities and Social Sciences accept or reject the proposal; or it will be sent back to the student and his or her sponsor with suggestions for modification and resubmission.

PHILOSOPHY AND RELIGION

Harrison Hall

Professor R. S. Bryan, Head of the Department

Associate Professor W. C. Fitzgerald, Coordinator of Advising and Assistant Head of the Department

Professor: P. A. Beidenberg, T. H. Regan. Associate Professors: W. R. Carter, W. L. Highfill, R. S. Metzger, A. D. Van DuVer. Assistant Professors or Emeriti: J. L. Middleton. Assistant Professors: D. D. Auerback, H. D. Levin, J. H. Merriam, R. T. Nagel, A. W. Sparer, M. A. Tibert, J. C. VanderKam. Lecturers: C. L. Stalnaker.

The Department of Philosophy and Religion at North Carolina State University 1) serves the needs of the University at large by providing courses devoted to the discussion of the great philosophic ideas of western civilization and of the religious notions that have had an impact on all of civilization, and 2) provides an opportunity for extensive technical study in philosophy for those 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.

Programs lead to two degrees in philosophy, the Bachelor of Arts and the Bachelor of Science.

BACHELOR OF ARTS DEGREE PROGRAM

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, 319), and a course in value theory (PHI 307, 308, 309, 311, or 312).

Bachelor of Arts Degree Program with a Concentration in 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, 319); a course in value theory (PHI 307, 308, 309, 311, 312); 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); a course in the history of western religions (REL 315, 316, 321, 323); and a course in theology and culture (REL 309, 325, 327).

BACHELOR OF SCIENCE DEGREE PROGRAM

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 307, 308, 309, 311, 312).

PHYSICAL EDUCATION

Carmichael Gymnasium

Professor F. R. Drews, Head of the Department

Assistant Professors: J. B. Edwards Jr., H. Keating, W. R. Leonhardt, W. H. Sonner. Assistant Professors: A. L. Biele, J. V. Brothers, R. C. Combs, N. E. Cooper, J. M. Danols, R. G. Gwyn, J. W. Isenhour Jr., M. S. Rhodes, J. L. Shannon, W. M. Shea, E. A. Smalts. Lecturers: M. B. Booth, M. J. Briggan, H. L. Brown, T. W. Cates, W. A. Cheek, T. W. Evans, V. M. Leath, S. L. Moore, R. H. Nicholson, C. E. Patch, L. E. Scott, J. G. Stewart, G. E. Wall, T. C. Winslow. Emeritus Associate Professor: A. M. Hoch.

North Carolina State University requires from two to four semesters in physical education to be taken consecutively during the freshman and sophomore years. The specific number of

semesters of required physical education is determined for each student by the Department of Physical Education. Insofar as faculty, facilities and allotment of time permits, each student is guided into courses which will best meet individual needs.

Prescribed Courses Prescribed courses are designed to meet the specific student needs as determined by tests. Prescribed courses are: Health and Physical Fitness, Beginning Swimming I, Beginning Swimming II, Restricted Activity I and Restricted Activity II. The Health and Physical Fitness course is required of all new freshmen. The Department of Physical Education also requires a demonstrated survival swimming ability or placement in the appropriate beginning swimming course.

Controlled Elective Courses—Elective courses are grouped under one of these areas: aquatics, combatives, developmental activities, individual sports and team sports. Students are encouraged to develop proficiency in at least two vigorous lifetime sports.

The courses PE 280, Emergency Medical Care and First Aid, and PE 285, Personal Health, are offered as electives but do not constitute credit towards meeting physical education requirements.

POLITICAL SCIENCE

Tompkins Hall

Professor G. David Garson, Head of the Department

Associate Professor K. S. Petersen, Coordinator of Advising

Professors: W J Block, F V. Cahill, J T Caldwell, A H. Itzman, R O Tilman, *Associate Professors:* J H Gilbert, H G Ketschull, J P Mastro, J M McClain, K. S. Petersen, M. S. Sorosis, J D. Williams; *Assistant Professors:* T D Edgmon, E. S. Fairchild, S. H. Kessler, E. R. Rubin, D W Stewart, J E Swiss, M L. Vasu, *Instructor:* J B. Roseh, *Visiting Associate Professor:* D O Vaughn

The Department of Political Science offers basic and advanced courses in all major fields of the discipline: American government and politics (local, state and national), comparative government and politics, international relations and organizations, political theory, public administration and methodology of political science. The department provides an area in which students may concentrate their major efforts, and it affords opportunities for the study of government and administration to students in other curricula and schools.

Graduate courses in political science are available at N. C. State and at Fort Bragg. See listing of graduate degree programs and consult the Graduate Catalog.

The department conducts a State Legislative Internship Program in alternate years. It also participates in the State Government Internship program, which functions under the sponsorship of the Institute of Government at Chapel Hill.

PROGRAMS IN POLITICAL SCIENCE

BACHELOR OF ARTS PROGRAM

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 deciles (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 (indicated by the letter "S" following its number, or by the word "seminar" in its title).

The department recommends that its majors, whenever practicable, take MA 111 and MA 112 in fulfillment of the School of Liberal Arts mathematics requirement.

Criminal Justice Option—The Departments of Political Science and Sociology and Anthropology offer undergraduate majors an option in criminal justice. This option includes 24 semester hours of specialized study. The program develops students who may move into middle management and policy making positions in agencies such as police, court, correctional, probation and parole agencies.

Students interested in criminal justice should contact Dr. Erika Fairchild, 221 Tompkins Hall, Political Science, or Dr. Elizabeth Suval, 230 1911 Building, Sociology and Anthropology.

Public Policy Concentration—The concentration in public policy studies is offered by the Department of Political Science as a curriculum for students interested in the setting and implementation of governmental priorities. The Public Policy Concentration is fulfilled by successful completion of twelve hours of core course requirements, nine hours of recommended political science electives, and completion of the normal political science major requirements (30 hours). Courses in the concentration emphasize public policy issues, analytic skills relevant to policy determination, and problems of implementing policy objectives. The concentration is suitable for those interested in continuing on to further study and careers in public administration, public service, and management.

Teacher Education Option—A major in political science may also choose a teacher education option. This is a 129 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.

BACHELOR OF SCIENCE PROGRAM

A concentration in political science requires 27 hours of course work in the discipline, including PS 202, PS 391 and a subsequent seminar in political science.

SOCIOLOGY AND ANTHROPOLOGY

(Also see Agriculture and Life Sciences)

1911 Building

Professor S. C. Mayo, Head of the Department

Associate Professor E. M. Suval, Assistant Head of the Department

Professor J. N. Young, Coordinator of Advising

TEACHING AND RESEARCH

Professors W. B. Clifford II, L. W. Drabek, C. P. Marsh, G. C. McFann, R. D. Mustian, M. M. Sawhney, J. N. Young, *Professors Emeriti* H. D. Rawls, *Associate Professor* E. Winston, *Associate Professors* R. C. Brisson, A. C. Davis, C. V. Mercer, R. L. Moxley, G. S. Nickerson, J. G. Peck, I. F. Busse, I. O. Uzzell, M. L. Walek, R. C. Wimberley, *Assistant Professors* W. T. Austin, C. G. Dawson, L. R. Della Fave, V. A. Hiday, T. M. Hyman, J. C. Leiter, P. T. McFarlane, W. C. Peebles, I. Ravner, M. D. Schulman, R. J. Thomson, K. M. Troost, J. M. Wallace, E. M. Woodrum, M. T. Zingraff, *Instructor* R. S. Eilovich, *Lecturers* SW J. S. Brown, E. B. Mackie, D. H. Solomon, L. R. Williams

EXTENSION

Professor J. N. Collins, In Charge of Community Development

Professors J. D. George, T. N. Holguod Jr., C. E. Lewis, M. E. Voland, *Professor Emeritus* J. W. Crawford, *Associate Professors* V. E. Hanilton, P. P. Thompson, *Assistant Professors* J. E. Burton, T. T. McKinney, *Extension Specialist* SH H. H. Goldstein

This department teaches students the principles and techniques for understanding human group behavior. The department seeks: 1) to train students to become leaders in organizing groups and communities and in administering programs; 2) to qualify exceptional students on the undergraduate and graduate levels for sociological research, teaching and extension work; 3) to solve problems in human group relations through scientific research; and 4) to extend research results to the people of the State.

BACHELOR OF ARTS DEGREE

The following departmental requirements must be met by all students majoring in sociology: A minimum of 30 hours in the major field including SOC 202, Principles of Sociology; SOC 301, Human Behavior; SOC 415, Social Thought; SOC 416, Research Methods; and a minimum of six elective courses in sociology, at least three at the 400 or higher level.

The department also requires 15 additional hours of social science including one course in psychology; ANT 252, Cultural Anthropology, and an additional ANT course are 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 credit 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. In addition, the student learns the basic concepts of economics, political science, anthropology and history, as well as sociology.

BACHELOR OF SOCIAL WORK DEGREE

The curriculum is accredited by the Council on Social Work Education and prepares students for the professional practice of social work in a variety of social welfare agencies, organizations and programs designed to enrich the quality of life and to improve social functioning of people served. Study will include the social, economic and political processes involved in the development and change of social welfare institutions, the dynamics of human behavior and the interventive methods and their application to a variety of situations and clients. Thirty-three hours of class and field instruction in social work, plus specified courses in the social sciences, the humanities, and natural sciences are required. Graduates have full professional status and may be granted advanced standing in a two-year Master's degree program in social work.

SPEECH-COMMUNICATION

Tompkins Hall

Professor W. G. Franklin, Head of the Department

Instructor Gail Schumacher, Coordinator of Advising

Professor C. A. Parker, Associate Professor Emeritus L. H. Swain; Associate Professors L. R. Camp, H. E. Munn Jr., Assistant Professors R. A. Francesconi, R. Leonard, J. D. Stone, N. H. Snow, B. L. Russell, Instructors E. Funkhouser, R. Rodgers, G. A. Schumacher

Speech-Communication is conceived as: (1) a humanistic study; (2) a social and behavioral science, and (3) a natural science. Characteristically, humanistic study of speech and its consequences employs historical, critical, philosophical, esthetic, and literal analyses of the intentions, actions, and effects of oral communication. Scientifically viewed as a symbolic interaction, speech is an object of empirical inquiry in laboratory and field. Conceived as physiological, acoustic, and learned behavior, speech-communication receives the rigorous experimental analyses of the biological and physical sciences. Such multiple approaches are requisite to comprehending the complexity of the speech act.

MAJOR IN SPEECH-COMMUNICATION

Bachelor of Arts Degree Program—The major in speech-communication includes 30 semester hours. The curriculum in speech-communication requires three prescribed courses in speech. The student may elect courses within the field from among offerings in broadcast communication, organizational and interpersonal communication, public communication, speech science communication and theatre communication to complete the 30-hour requirement.

SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCES

Cox Hall

A. C. Menius Jr., *Dean*

J. D. Memory, *Associate Dean*

The School of Physical and Mathematical Sciences trains potential scientists and mathematicians; gives technical support to curricula in North Carolina State's other seven schools; and does research in physical sciences and mathematics. These activities are carried out by eight academic departments: biochemistry, chemistry, computer science, statistics, geosciences, marine science and engineering, mathematics and physics. The Institute of Statistics (Raleigh section) and Physical Sciences Research are also associated with the School of Physical and Mathematical Sciences.

Graduates of the school 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 leading to the Master of Science and Doctor of Philosophy degrees.

The high school student with an above average performance in mathematics, chemistry or physics, and a basic interest in natural phenomena and their mathematical descriptions, should consider a career in physical sciences or mathematics. The school consistently attracts outstanding students; approximately one third of its students graduate with honors or high honors.

FACILITIES

Classrooms and school offices in the campus' center are listed under each department. In addition, physics research laboratories are located in Daniels Hall and the Nuclear Science Building and at the Triangle Universities Nuclear Laboratory in Durham. Biochemistry research is underway in Polk Hall.

Special equipment and laboratories include a plasma physics laboratory supported by a research tube making facility; a radio chemistry laboratory; a one-million volt Van de Graaff accelerator; analog and ambilog computers; an IBM 1130 digital; a laser research laboratory; a Varian Associates HA-100 high resolution nuclear magnetic resonance spectrometer; an upper atmosphere laboratory; a biomathematics and biophysics laboratory; undergraduate and graduate desk computing laboratories; biochemical research and teaching laboratories; and an ultraviolet-infrared visible spectroscopic laboratory. Other campus facilities for teaching and research are electron microscopes, a heterogeneous nuclear reactor designed for operation at 100 kilowatts, complete x ray laboratories with diffraction and radiographic equipment, a Beckman Model E analytical ultracentrifuge, precision instrument shops, and an IteI AS/4 digital computer connected by telecommunication lines to a twin IBM 370/165 system at the Triangle Universities Nuclear Laboratory which has a 0-35 Mev. cyclotron accelerator.

CURRICULA

The school offers undergraduate programs of study leading to the Bachelor of Science degree with a major in chemistry, computer science, geology, mathematics, meteorology, physics or statistics. These curricula have similar freshman years, enabling a freshman to change, without loss of time, from one department to another in the school. In addition, the school offers programs of study leading to the Bachelor of Arts degree with a major in geology and chemistry.

SHORT COURSES AND INSTITUTES

Several short courses and specialized institutes are offered throughout the academic year and during the summer months in chemistry, computer science, geology, mathematics,

physics, and statistics for high school teachers and college professors. For information, write the school dean.

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 in the Greensboro-Burlington-Winston-Salem area. For information write North Carolina State University Division of Continuing Education, Raleigh.

SUPERIOR STUDENT AND HONOR PROGRAMS

Exceptional students may be selected to participate in the Superior Student Program during their freshman and sophomore years. 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, participate in undergraduate research, and receive some graduate credit toward the Master of Science degree during the senior year.

Well-prepared students entering the school may seek advanced placement in biology, chemistry, foreign language, history, mathematics, or physics by passing qualifying examinations.

STUDENT ACTIVITIES

In addition to University-wide extracurricular activities and honor organizations, the School 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, and the Association for Computing Machinery.

The Science Council, composed of elected students from the school, 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 biochemistry, biomathematics, chemistry, computer studies, geology, marine sciences, statistics, mathematics, applied mathematics and physics. The Master of Biomathematics is offered. The Doctor of Philosophy degree is available in biochemistry, biomathematics, chemistry, marine sciences, statistics, mathematics, applied mathematics and physics.

BIOCHEMISTRY

(See Agriculture and Life Sciences)

CHEMISTRY

Dabney Hall and Withers Hall

Professor C. L. Bumgardner, Head of the Department

Professor R. H. Loeppert, Assistant Head of the Department and Coordinator of Advising

Professors: H. A. Bent, J. Boriner, L. H. Bowen, H. H. Carmichael, Graduate Administrators: M. K. DeArmond, L. D. Free Inan, F. W. Getzen, K. W. Hanck, F. C. Hentz Jr. (Director of General Chemistry), Z. Z. Hugus Jr., S. G. Levine, G. G. Long, C. G. Moreland, A. F. Schreiner, W. P. Tucker, G. H. Wahl Jr., Adjunct Professors: M. E. Wall, Professor Emeriti: G. O. Doak, W. J. Peterson, W. A. Reid, P. P. Sutton, R. C. White, Associate Professors: T. C. Caves, A. F. Coats, C. E. Gleit, L. A. Jones, M. L. Miles (Director of Organic Laboratories), W. L. Switzer, D. W. Wertz, Associate Professor Emeritus: W. E. Jordan, Assistant Professors: C. R. Boss, Y. Ehisuzaki, W. R. Johnson, S. T. Purrington, T. M. Ward; Visiting Assistant Professor: M. Whangbo, Assistant Professors Emeriti: T. J. Blalock, W. P. Ingram Jr., Instructors Emeriti: E. H. Manning, J. W. Morgan, G. M. Oliver; Laboratory Supervisors: C. E. Bryan, G. J. Shaw; Teaching and Research Technicians: M. E. Bundy, D. E. Knight; Teaching Technicians and General Chemistry Laboratory Coordinator: M. M. Girozani

Chemistry is the science dealing with the composition of all substances and changes in their composition. Chemists have contributed to the synthetic fiber industry, petroleum products and fuels, plastics, the food processing industry, nuclear energy, 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 new ones and control of our 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 is open to the chemist; biochemistry, metallurgy, space science, oceanography, sales or management, pure research. Chemists are employed in almost every field based on modern technology and opportunities in the field of education are many and varied. The Bachelor of Science program in chemistry provides an excellent premedical curriculum.

UNDERGRADUATE CURRICULA

BACHELOR OF SCIENCE IN CHEMISTRY

The Bachelor of Science curriculum (shown below), 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 minor field and elective credits allow individual diversity at the junior and senior levels. Many undergraduates participate in current departmental research through part-time employment or a senior research project. The curriculum prepares the student for jobs open to the Bachelor of Science chemist or for advanced graduate work. See listing of graduate degrees and consult the Graduate Catalog.

BACHELOR OF ARTS IN CHEMISTRY

The B.A. program offers a much more flexible course of studies for students who do not wish to become professional chemists but who desire an interdisciplinary program with an emphasis on Chemistry. Recent graduates have gone on to Medical School and to graduate study in fields related to Chemistry. Among the 127 credit hours required for graduation are thirty credits of Chemistry and thirty-three hours of electives. Since the first year is identical to that of the B.S. program, students may enter the B.A. program either directly from high school or at the end of their first year. Complete details are available in the Chemistry Department (Dabney Hall).

B.S. CHEMISTRY CURRICULUM

		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
CH 106	Laboratory Techniques I	1	CH 108	Laboratory Techniques II	1
ENG 111	Composition and Rhetoric	3	ENG 112	Composition and Reading	3
MA 102	Analytic Geometry and Calculus I	4	MA 201	Analytic Geometry and Calculus II	4
Social Science		3	PY 201	General Physics*	4
Physical Education		1	Physical Education		1
		16			17

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
English Elective	3	English Elective	3
MA 202 Analytic Geometry and Calculus III	4	MA 301 Applied Differential Equations I	3
PY 202 General Physics*	4	PY 203 General Physics*	4
Physical Education	1	Free Electives	3
	16	Physical Education	1
			18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 428 Qualitative Organic Analysis	3	CH 401 Systematic Inorganic Chemistry	3
CH 431 Physical Chemistry I	3	CH 433 Physical Chemistry II	3
Humanities Social Sciences	3	CH 434 Physical Chemistry II Laboratory	2
FLG 101 Elementary German I	3	Humanities Social Sciences	3
Minor**	3	FLG 102 Elementary German II	3
	15	Minor	3
			17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 411 Analytical Chemistry I	4	CH 413 Analytical Chemistry II	4
Chemistry Elective	2	Humanities Social Sciences	3
Humanities Social Sciences	3	Minor	3
Minor	3	Free Electives	5
Free Electives	4		16
	16		
		Hours Required for Graduation	131

* The sequence PY 205, 206, 407 may be substituted for PY 201, 202, 203, with approval of the adviser.

** The minor may be in any field closely related to chemistry, such as mathematics, physics, computer science, geoscience, statistics, biological sciences, engineering or science education. A total of four courses in two such areas may constitute a "split" minor. The minor field should be chosen in consultation with the faculty adviser prior to or during the junior year.

B.A. CHEMISTRY CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry	4	CH 107 Principles of Chemistry	4
MA 102 Analytic Geometry and Calculus I	4	MA 201 Analytic Geometry and Calculus II	4
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
Humanities—Social Sciences*	3	PY 205 General Physics	4
Physical Education	1	Physical Education	1
	15		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 General Physics	4	Science Elective	4
Humanities—Social Sciences*	6	Humanities Social Sciences*	3
Physical Education	1	Free Elective	3
	15	Physical Education	1
			15

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
BCH 361 Elementary Biochemistry	3	CH 315 or CH 317 Quantitative Analysis	4
Science Elective	4	Humanities Social Sciences*	6
Humanities Social Sciences*	6	Advised Elective**	4
Free Elective	3	Free Elective	3
	16		17

SENIOR YEAR

Fall Semester	Credits	Spring Semester	Credits
CH 331 Introductory Physical Chemistry	4	CH 401 Systematic Inorganic Chemistry	3
Humanities—Social Sciences*	3	Humanities—Social Sciences*	3
Advised Electives**	7	Advised Electives**	7
Free Elective	3	Free Elective	3
	17		16
		Hours Required for Graduation	127

Because of the inherent flexibility of the B.A. Curriculum in Chemistry a student entering into the program must submit an Application for Admission and a Plan of Work, giving reasons for the selection of course work.

* These credits should be distributed approximately equally between the humanities (fine arts, history, literature, languages, philosophy, and religion) and the social sciences (anthropology, economics, political science, psychology and sociology). No more than 10 credit hours in a single discipline may be used to satisfy the requirement. At least 12 credits must come from courses beyond the introductory level.

** Advised electives are designed to allow the student to concentrate efforts in the complementary field of his choice.

COMPUTER SCIENCE

Daniels Hall

Professor D. C. Martin, Head of the Department

Associate Professor T. L. Honeycutt, Associate Department Head and Coordinator of Advising

Professor: W. Chou; Adjunct Professor: L. H. Williams; Associate Professors: E. W. Davis Jr., R. J. Fornaro, L. Mansfield, D. F. McAllister, J. D. Powell, W. E. Robbins, A. L. Tharp; Assistant Professors: L. E. Deimel Jr., J. W. Hanson, C. D. Savage, K. C. Tai, N. F. Williamson; Adjunct Assistant Professor: R. L. Glendenning; Instructors: C. E. Grad, M. J. Lee; Adjunct Lecturer: F. L. Benson; Special Lecturer: F. W. Houghtaling

The discipline of computer science has developed during the past 25 years as a direct consequence of rapid growth of the electronic computer. This technological development has great impact on man and the way he lives. Almost all areas of industry, the military establishment, government agencies, education and business use computers and new applications continue to arise. Computers are used to help make and operate our automobiles, airplanes and space ships; to help design our highways, bridges and buildings; to handle banking transactions and to assist in management decisions; to analyze farm production; as a research tool for the scientist; to monitor manufacturing processes, utilities and communication; and to provide a multitude of other services.

OPPORTUNITIES

A wide range of jobs exist for computer scientists since computers have diverse applications. Salaries are good for both men and women. There is a need for basic research into the principles of computer system design and the analysis of computational algorithms and students may choose to continue their training with graduate study.

CURRICULUM

This undergraduate curriculum leads to a degree of Bachelor of Science in computer science. Core courses provide foundations in programming and computer languages, the structure of data, computer architecture, solution methods including numerical analysis and simulation, and the theory of computation. The restricted electives chosen in consultation with one's adviser during the junior year allow exploration of specific computer science areas or fields such as information science, operating systems, computer architecture, and analysis of algorithms. One may study fields in which there are significant computer applications like management, physical, biological and social sciences, numerical analysis and statistics.

Students in other departments may select courses in computer science as electives to broaden their programs of study and to learn how to use the computer for solving problems.

COMPUTER SCIENCE CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 101 Introduction to Programming	3	CSC 102 Programming Concepts	3
MA 102 Analytic Geometry and Calculus I	4	MA 201 Analytic Geometry and Calculus II	4
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
Basic Science	3	Basic Science	3
PE 100 Health and Physical Fitness	1	Physical Education	1
	14		14

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 201 Basic Computer Organization and Assembly Language	3	CSC 202 Concepts and Facilities of Operating Systems	3
MA 202 Analytic Geometry and Calculus III	4	CSC 302 Introduction to Numerical Methods or	
PY 205 General Physics	4	CSC 311 Data Structures	3
Humanities—Social Sciences	3	MA 405 Introd. to Linear Algebra and Matrices	3
ENG Literature	3	PY 208 General Physics	4
Physical Education	1	Humanities Social Science	3
	18	Physical Education	1
			17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 311 Data Structures or		CSC 312 Computer Organization and Logic	3
CSC 302 Introduction to Numerical Methods	3	CSC 412 Introduction to Computability, Language and Automata	3
CSC 322 Applied Algebraic Structures	3	ST 372 Introduction to Statistical Inference and Regression	2
ST 371 Introduction to Probability and Distribution Theory	2	Humanities Social Sciences	3
ENG 321 Communication of Technical Information	3	Restricted Elective	3
Humanities—Social Sciences	3	Free Electives	3
Free Elective	3		
	17		17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CSC 411 Introduction to Simulation	3	Restricted Elective	3
Restricted Elective	3	Restricted Elective	3
Restricted Elective	3	Restricted Elective	3
Restricted Elective	3	Humanities Social Science	3
Humanities—Social Sciences	3	Free Elective	3
Free Elective	3		
	18		15
		Total Hours Required for Graduation	130

COMPUTER STUDIES PROGRAM

Professor W. Chou, Director

Associate Professor W. E. Robbins, Associate Director

Professors: W. S. Galler, H. J. Gold, D. C. Martin, J. B. O'Neal, J. Staudhammer; *Associate Professors:* E. W. Davis, R. J. Fornaro, J. W. Gault, T. L. Honeycutt, L. Mansfield, J. D. Powell, J. C. Smith, R. S. Sowell, A. L. Tharp; *Adjunct Associate Professors:* J. R. Suttle; *Assistant Professors:* L. E. Deimel, W. A. Gruver, J. W. Hanson, D. M. Latch, C. D. Savage, W. E. Snyder, R. E. Stinner, R. W. Stroh, K. C. Tai, N. F. Williamson; *Instructors:* C. E. Grad, M. J. Lee

The Computer Studies Program is an interdisciplinary graduate program which is administratively supported by the Departments of Computer Science and Electrical Engineering with participation by faculty members primarily from Computer Science, Electrical Engineering, and Operations Research.

The program integrates the computer software oriented curriculum of the Department of

Computer Science and the computer hardware oriented curriculum of the Department of Electrical Engineering into a single curriculum.

The program offers Master of Science and Master of Computer Studies degrees. A joint computer studies/operations research Ph.D. is offered through the Operations Research Program.

GEOSCIENCES

Withers Hall

Professor C. J. Leith, Head of the Department and Coordinator of Advising

Professors: H. S. Brown, E. G. Drusner, W. J. Saucier, C. W. Welby. Professors Emeriti: J. M. Parker III, J. L. Stuckey. Associate Professors: M. J. Aldrich, S. P. S. Arya, V. V. Cavároc Jr., C. D. Harrington, G. F. Watson. Adjunct Associate Prof. of F. S. Binkowski. Associate Professor Emeritus: E. L. Miller Jr. Assistant Professors: R. V. Fodor, A. J. Rior dan, E. F. Stoddard, I. J. Won. Ad. uet Assistant Professors: W. D. Bach Jr., J. K. Ching, R. E. Eskeridge

The geosciences include the overlapping divisions of the physical, chemical and biological earth sciences, such as geology, geophysics, geochemistry, hydrology, meteorology, and paleontology. The Department of Geosciences offers courses in these disciplines and awards the B.A. and B.S. degrees in geology and the B.S. degree in meteorology. (See listing of graduate degrees offered and consult the Graduate Catalog.)

Geology is the professional field in which geological knowledge and techniques are focused on the solution of problems concerned with the environment, with the occurrence, origin, distribution and behavior of rocks, with mineral deposits, with raw material supplies and with a variety of engineering projects. Many engineering undertakings—siting and construction of dams and reservoirs, tunnels, buildings and highways—depend on geological setting knowledge. Discovery, evaluation, development and conservation of mineral resources (including fossil fuels and ground water) and the disposal of liquid and solid wastes require quantitative and analytical application of geologic principles.

Meteorology is the science of the atmosphere, including the processes and the phenomena within the atmosphere, the interactions with earth's land and sea surface below and with the solar atmosphere above. Its objectives are to apply understanding of the atmosphere and the processes within to benefit mankind in his welfare and endeavors. The meteorology curriculum provides basic training for roles in both theory and application. The student is prepared for research or professional applications.

No activity on earth is unaffected by the natural conditions and processes of our atmospheric environment. A familiar purpose of meteorology is to provide weather forecasts so man may protect himself intelligently from damages by weather and plan beneficially his individual activities for the immediate future. In addition to weather information reports to the public, meteorology reaches into broader aspects of environmental technology. Increasing concern about "environmental quality," in relation to operations and welfare, and to the impacts on air quality by commerce and industry have led to expanded concepts of atmospheric monitoring and the need for research and services applied to industrial operations, environmental planning and government regulation. Among meteorology fields are atmospheric pollution, weather modification and control, and interrelations with agriculture, industry and marine science.

Remote sensing imagery provides a new dimension to geosciences. These data are utilized for teaching and research.

OPPORTUNITIES

Geologists are employed by oil companies, quarrying concerns, exploration companies, construction firms, railroads, public utilities, banks and insurance companies; iron, steel and other metal producers, manufacturers using nonmetallic raw materials such as ceramics, cement and abrasives; municipal, state and federal government agencies, schools, colleges, museums and research institutes. There is a growing need for the application of geological science to engineering construction in connection with highways, foundations, excavations, beach erosion control and water supply problems. The mineral industry of the Southeast has expanded substantially in the last decade.

Basic meteorological services are provided by federal government agencies, primarily the National Oceanic and Atmospheric Administration and components of the Department of Defense; these agencies are the principal employers of meteorologists. This work may involve atmospheric sensing and measurement, including the use of meteorological satellites and space probes; data analysis and computation; weather forecasting, and guidance services to aeronautics, agriculture, forestry, hydrology, and recreation and public health. Meteorologists are used in environmental planning and regulation at the state and local levels. Power generating and fuel transmission industries, engineering firms, weather consulting firms, insurance companies, major retailing businesses, and schools and colleges and research institutions are employing meteorologists because of recognition of the involvement of the atmosphere on their activities.

CURRICULA

The B.A. and B.S. degree programs in geology are the same with respect to courses in the major field, but differ in their content of social science-humanities, mathematics, and collateral physical sciences. The B.A. program is designed to be a typical liberal arts curriculum, while the B.S. program reflects the technical emphasis typical of curricula in the physical sciences. The B.S. degree program in meteorology also follows the pattern of physical sciences curricula.

GEOSCIENCES CURRICULA

B.A. DEGREE PROGRAM IN GEOLOGY

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
MA 112 Anal. Geom. & Calc. A	4	MA 212 Anal. Geom. & Calc. B	3
Soc. Sci. Hum *	3	Soc. Sci. Hum *	3
GY 101 Gen. Physical Geology	3	GY 201 Historical Geology	3
GY 110 Physical Geology Lab	1	GY 210 Historical Geology Lab	1
Physical Education	1	Physical Education	1
	15		14

SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
SP 110 Public Speaking	3	ST 311 Intro. to Statistics	3
CH 101 General Chemistry I	4	CH 103 Gen. Chemistry II	1
Soc. Sci. Hum *	3	Soc. Sci. Hum. *	3
GY 330 Crystallography & Mineralogy	3	GY 331 Optical Micr. & X-Ray Diff.	4
Elective	3	Physical Education	1
Physical Education	1		15
	17		

JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credit</i>	<i>Spring Semester</i>	<i>Credit</i>
PY 211 General Physics	4	PY 212 General Physics	4
ENG 321G Communic. of Tech. Inf.	3	GY 451 Structural Geology	1
CSC 111 Intro. to Fortran Prog.	2	GY 152 Sed. Petr. & Stratig.	4
GY 440 Igneous & Metamorphic Petr.	4	Soc. Sci. Hum *	4
Soc. Sci. Hum *	3		15
	16		

SUMMER SESSION

GY 169 Geologic Field Camp 6

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GY 423 Invertebrate Paleo. & Biostratig	4	Geology Elective**	3
Geology Elective**	3	Soc. Sci.-Hum.*	3
Geology Elective**	3	Soc. Sci. Hum.*	3
Soc. Sci. Hum.*	3	Elective	3
Elective	3	Elective	3
	16		15
		Hours Required for Graduation	125

* A course in each of at least three Humanities (Fine Arts, History, Literature, Language, Philosophy, Religion) and in each of at least three Social Sciences (Anthropology, Economics, Political Science, Psychology, Sociology). At least nine hours must come from courses beyond the introductory level.

** Geology elective shall include at least one of the following: GY 415, Geology of Metalliferous Deposits, GY 461, Engineering Geology, GY 470, Principles of Geophysics.

B.S. DEGREE PROGRAM IN GEOLOGY

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ENG 111 Composition & Rhetoric	3	ENG 112 Composition & Reading	3
MA 102 Anal. Geom. & Calc. I	4	MA 201 Anal. Geom. & Calc. II	4
CH 101 General Chemistry I	4	CH 103 General Chemistry II or	4
GY 101 General Physical Geology	3	CH 107 Prin. of Chemistry	4
GY 116 Physical Geology Lab	1	GY 201 Historical Geology	3
Physical Education	1	GY 210 Historical Geology Lab	1
	16	Physical Education	1
			16

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
SP 110 Public Speaking	3	MA 301 Applied Differential Equations I	3
MA 202 Anal. Geom. & Calc. III	4	PY 208 General Physics	4
PY 205 General Physics	4	GY 331 Optical Micr. & X ray Diffr.	4
GY 330 Crystallography & Mineral.	3	Soc. Sci. Hum.	3
Physical Education	1	Physical Education	1
	15		15

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ST 361 Intro. to Stat. For Engr.	3	GY 351 Structural Geology	4
CH 331 Introductory Physical Chemistry	4	GY 452 Sed. Petr. & Stratig	4
GY 440 Igneous & Metamorphic Petr.	4	CSC 111 Intr. to Fortran Prog.	2
ENG 321G Comm. of Tech. Inf.	3	Elective	3
Soc. Sci. Hum.	3	Soc. Sci.-Hum.	3
	17		16

SUMMER SESSION

GY 465 Geologic Field Camp	6
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SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
GY 423 Invertebrate Paleo. & Biostratig	4	Geology Elective**	3
Geology Elective**	3	Geology Elective**	3
Technical Elective*	3	Technical Elective*	3
Soc. Sci. Hum.	3	Soc. Sci.-Hum.	3
Elective	3	Elective	3
	16		15
		Hours Required for Graduation	132

* The Technical Elective shall be at least two courses, not both at the introductory level, related to the Geology curriculum such as: Biological Science, Chemistry, Civil Engineering, Computer Science, Economics, Materials Engineering, Mathematics, Meteorology, Physics, Soil Science, Statistics, etc.

** Geology elective shall include at least one of the following: GY 415, Geology of Metalliferous Deposits, GY 461, Engineering Geology, GY 470, Principles of Geophysics.

B.S. DEGREE PROGRAM IN METEOROLOGY

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
CH 101 General Chemistry I	4	CH 105† Chemistry Princp. & Appl.	3
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 102 Anal. Geom. and Calc. I	4	MA 201 Anal. Geom. and Calc. II	4
Humanities—Social Sciences	3	PY 205 General Physics	4
Physical Education	1	Physical Education	1
	15		15

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 202 Anal. Geom. and Calc. III	4	MA 301 Applied Diff. Equa. I	3
PY 208 General Physics	4	ST 371 Intro. Prob. & Dist. Theory	2
MY 311 Physical Climatology	3	CSC 111 Introduction to Fortran Programming	2
MY 335 Weather Systems and Info.	2	Geophysical Sciences Elective††	3
MY 336 Meteorological Lab. I	1	Communicative Arts†††	3
Physical Education	1	Humanities—Social Sciences	3
	15	Physical Education	1
			17

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MY 421 Air Properties and Processes	3	MY 441 Meteorological Analysis I	3
MY 422 Atmospheric Motions	3	MY 443 Meteorological Lab. II	3
ST 372 Intro. Stat. Inf. & Regres.	2	MY 455 Micrometeorology	3
Technical Elective B**	3	Humanities Social Sciences	3
Communicative Arts†††	3	Free Elective	3
Free Elective	3		15
	17		

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Meteorology Technical Elective***	3	MY 412 Atmospheric Physics	3
Technical Elective A*	3	Technical Elective A*	3
Technical Elective B**	3	Technical Elective B**	3
Humanities—Social Sciences	3	Humanities Social Sciences	3
Free Elective	3	Free Elective	3
	15		15

Hours Required for Graduation124

† Students who intend to take additional chemistry courses, or who plan technical electives which require additional chemistry, should add CH 104 or replace CH 105 with CH 103 or CH 107. Advanced transfer students are permitted to substitute mathematics, science, or engineering credits for CH 105.

†† Geophysical sciences elective is selected from among GY 101, GY 120-110, MSE 200, PY 223, SSC 200, CE 201 or 370, FOR 272.

††† Two courses in a foreign language, or one course each in speech and technical writing.

* Technical elective A includes courses in the sciences, agriculture, and engineering, chosen from lists approved by the major department and school, but excluding more than one advanced course in meteorology.

** Technical elective B constitutes a minor field of emphasis, consisting of at least nine credits in that subject. Among those available, but not limited to them, are: chemistry, computer science, geology (physical geology, geophysics), mathematics, physics (senior courses), statistics (should include a 600-level course), chemical engineering (heat transfer, fluid mechanics, air pollution), civil engineering (geodetics, hydrology, sanitation), electrical engineering (field theory, wave propagation, instrumentation), engineering science and mechanics (fluid mechanics), mechanical-aerospace engineering (heat transfer, fluid mechanics), forestry (protection, mensuration, management), health science (significantly involving atmospheric environment), marine science (upper division and graduate), plant science (significantly involving atmospheric environment), soil science (should include SSC 511).

*** Meteorology Technical Elective to be chosen from MY 444 or MY 556.

MARINE SCIENCE AND ENGINEERING

Burlington Lab

Professor Jay Langfelder, Head of the Department

Associate Professor G. S. Janowitz, Coordinator of Advising

Associate Professors: C. E. Knowles, J. L. Mahemehl, L. J. Pietrafesa, M. A. Tafun, T. G. Wood, *Assistant Professors:* D. J. DeMaster, C. A. Nitzsche, R. H. Wood, *Instructors:* T. B. Curtin, E. Levin, *Specialist:* S. M. Rogers Jr., *Associate Faculty Professors:* S. M. Amin, B. J. Copelan, I. W. W. Hawley, I. Longmair, F. Y. Sorrell, C. C. Tung, *Associate Professor:* J. M. Miller

Instruction in marine science and engineering is primarily at the graduate level. It is the belief of the faculty that a strong foundation in one of the sciences or engineering is needed before a student concentrates in marine related fields. Therefore, our graduate students are drawn from undergraduate programs in biology, chemistry, engineering, geology, mathematics or physics.

The Department offers an introductory course at the undergraduate level which provides a survey of several aspects of the marine science field. Several advanced undergraduate and beginning graduate level courses are available for senior level students. Students interested in pursuing a graduate program in marine science and engineering may wish to enroll in these courses as electives.

The graduate program provides areas of study in biological, chemical, geological and physical oceanography and in coastal engineering. Opportunities for financial support and involvement in an active research program are available to our graduate students.

MATHEMATICS

Harrison Hall

Professor J. M. Ortega, Head of the Department

Professor W. J. Harrington, Assistant Head of the Department and Coordinator of Advising

Associate Professor J. B. Wilson, Assistant Head of the Department

Professors: J. W. Bisher, E. E. Burniston, R. E. Chandler, J. M. A. Danby, W. G. Dotson, R. O. Falp, K. Koh, J. R. Kolb, J. Lub, J. A. Marlin, R. H. Martin Jr., C. D. Meyer Jr., P. A. Nickel, N. J. Rose, H. Sagan, H. E. Speece, E. L. Stitzinger, R. A. Strubbe, *Professors Emeriti:* J. Levine, H. M. Nahikian, H. V. Park, L. S. Winston, *Associate Professors:* S. L. Campbell, H. C. Cooke, J. C. Dunn, R. Hartwig, C. H. Little, A. Maltbie, L. Mansfield, L. B. Page, C. V. Pan, H. A. Petrea, M. Puteh, J. A. Reuber, R. G. Savage, R. Silber, W. M. Waters, *Associate Professors Emeriti:* A. R. Nolstad, D. M. Peterson, *Assistant Professors:* C. N. Anderson, H. J. Charlton, L. O. Chung, J. Cohen, G. D. Faulkner, J. E. Franke, M. L. Gardner, D. E. Garoutte, D. J. Hansen, C. Kelley, T. Lada, D. M. Latch, M. Mostow, J. Nelson, S. O. Paur, R. T. Ramsay, S. Schecter, J. F. Schrade, J. W. Silverstein, M. F. Singer, G. A. Sod, P. Sommers, J. L. Sos, D. F. Ullrich, R. E. White, *Assistant Professors Emeriti:* C. F. Lewis, G. S. Spindel, *Instructors:* H. L. Crouch, H. L. Davison, T. F. Gordon, *Instructor Emeriti:* D. Brant, *Associate Members of the Department:* L. H. van der Vaart, O. Wesler

The undergraduate major in mathematics provides a core of basic mathematics courses with a program of electives sufficiently flexible to prepare a student for graduate study in pure or applied mathematics. See listing of graduate degrees for careers in industry, business or government, or for teaching. A carefully selected set of required courses and electives in science, humanities and modern language provides a program well adapted to the demands of modern day life.

Students with a special interest may take the applied mathematics option.

REQUIREMENTS FOR BACHELOR OF SCIENCE IN MATHEMATICS

Required Mathematics Courses (30 credits)

- MA 102 201 202 Analytic Geometry and Calculus I, II, III
- MA 114 Introduction to Finite Mathematics with Applications
- MA 312 Introduction to Differential Equations
- MA 403M Introduction to Modern Algebra

MA 405M Introduction to Linear Algebra and Matrices	
MA 425 Mathematical Analysis I	
MA 426 Mathematical Analysis II or MA 512 Advanced Calculus II	
Mathematics Electives (12 credits)	
Twelve (12) credits of Mathematics courses at 400-500 levels.	
Science and Mathematics related Requirements (17-19 credits)	
CH 101	
CSC 101 or CSC 111	
MA 421 or ST 371-372	
PY 205-208 (or PY 201-202)	
Science and Math related Electives (12 credits)*	
(1) At least 5 additional credits of physical science, engineering science, or life science (6-12 credits)	
(2) Additional courses in Computer Science and/or Statistics (0-6 credits)	
Required Humanities (15 credits)	
English 111, 112	
English or American Literature one semester	
Introductory History one semester	
Foreign Language completion of the intermediate course (FL 201)	
Humanities/Social Sciences Electives (18 credits)	
At least six (6) of the eighteen credits must be at the 300 or 400 level.	
Physical Education (4 credits)	
Free Electives (16-18 credits)	
Hours Required for Graduation	126

* These elective courses require the approval of the student's advisor.

REQUIREMENTS FOR APPLIED MATHEMATICS OPTION

Required Mathematics Courses (33 credits)	
MA 102-201-202 Analytic Geometry and Calculus I, II, III	
MA 114 Introduction to Finite Mathematics with Applications	
MA 312 Introduction to Differential Equations	
MA 403M Introduction to Modern Algebra	
MA 405M Introduction to Linear Algebra and Matrices	
MA 425 Mathematical Analysis I	
MA 426 Mathematical Analysis II or MA 512 Advanced Calculus II	
MA 430 or MA 432 Mathematical Models (in the Physical Sciences or in Life Sciences, Social Sciences and Economics)	
Mathematics Electives (6 credits)	
Six (6) credits of Mathematics courses at 400-500 levels.	
Science and Mathematics-related requirements (17-19 credits)	
CH 101	
CSC 101 or CSC 111	
MA 421 or ST 371-372	
PY 204-208 (or PY 201-202)	
Applied/Career-oriented electives (15 credits)	
(1) Twelve (12) credits* (in depth) in one Math-related or career-oriented area;	
(2) Three (3) additional credits in science. (This may be replaced by a 400-500 Math elective if the 12 credits in (1) are all in science.)	
Required Humanities (15 credits)	
English 111, 112	
English or American Literature one semester	
Introductory History one semester	
Foreign Language completion of the intermediate course (FL 201)	
Humanities/Social Sciences Electives (18 credits)	
At least six (6) of the eighteen credits must be at the 300 or 400 level.	
Physical Education (4 credits)	
Free Electives (16-18 credits)	
Hours Required for Graduation	126

* These elective courses require the approval of student's advisor.

SAMPLE PROGRAM IN MATHEMATICS

(Includes the Applied Mathematics Option)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 102M Analytic Geometry and Calculus I	4	MA 201M Analytic Geometry and Calculus II	4
CH 101 General Chemistry I	4	MA 114 Intro. to Finite Mathematics with Applications	3
ENG 111 Composition and Rhetoric	3	ENG 112 Composition & Reading	3
Introductory History	3	Science Elective	3-4
Physical Education	1	CSC 101 Intro to Programming	3
	15	Physical Education	1
			17-18

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 202M Analytic Geometry and Calculus III	4	MA 312 Intro to Differential Equations	3
PY 205 General Physics	4	MA 403M Intro. to Modern Algebra	3
English or American Literature	3	PY 208 General Physics	4
Foreign Language	3	Humanities Social Science Elective	3
Science/Math-related Elective	3	Free Elective	3
Physical Education	1	Physical Education	1
	18		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
MA 405M Intro to Linear Algebra and Matrices	3	MA 421 Intro to Probability	3
MA 425 Mathematical Analysis I	3	MA 426 Mathematical Analysis II	3
Science Math related Elective	3	Science/Math-related Elective	3
Humanities Social Sciences Elective	3	Humanities/Social Science Elective	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>
Mathematics Elective	3	Mathematics Elective*	3
Mathematics Elective	3	Mathematics Elective	3
Humanities/Social Sciences Electives	6	Humanities/Social Science Elective	3
Free Elective	3	Free Electives	6
	15		15
		Hours Required for Graduation	126

* Replace by MA 430 for the Applied Mathematics Option

PHYSICS

Cox Hall

Professor R. R. Patty, Head of Department

Professor G. E. Mitchell, Coordinator of Advising

Professors: W. R. Davis, W. O. Doggett, G. L. Hall, A. W. Jenkins Jr., G. H. Katzin, E. R. Manning, J. D. Memory, A. C. Menius Jr., G. E. Mitchell, J. Y. Park, L. W. Saugondollar, D. R. Tilley, A. W. Walther; *Professors Emeriti:* W. H. Bennett, F. W. Lancaster, J. T. Lyon, L. H. Thomas; *Associate Professors:* K. T. Chung, C. C. Cobb, C. R. Gould, C. E. Johnson, Fred Lado, D. H. Martin, G. W. Parker, J. F. Schetzina; *Assistant Professors:* S. R. Cotanch, D. G. Haase, Jin Kim, M. A. Klenin, J. R. Mowat, H. L. Owen, J. S. Risle, D. E. Sayers; *Associate Members of the Department:* J. M. A. Danby (Mathematics), R. E. Fornes (Textiles), R. L. Murray (Nuclear Engineering), D. L. Ridgeway (Statistics)

Physics is the fundamental science of observation, measurement and the mathematical description of the particles and processes of nature. In addition to extending our basic

knowledge of the universe, physics provides the means for attacking problems of importance in modern technology. The variety of the contributions made by physicists is indicated by activities such as the discovery of new basic particles of nature, the invention and use of new instruments to probe interplanetary space, the study of processes fundamental to the release of thermonuclear energy, the development of lasers and solid state devices, the research on the structure and interaction of 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 particular individual interest. At the graduate level, a comprehensive fundamental preparation is followed by specialization and research in one of the following areas: atmospheric, atomic, nuclear, nuclear magnetic resonance, plasma, relativity and solid state physics. (See listing of graduate degrees and consult the Graduate Catalog.)

UNDERGRADUATE STUDY

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.

PHYSICS CURRICULUM

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PY 101 Perspectives on Physics	1	PY 201 General Physics	4
CH 101 General Chemistry I	4	MA 201 Analytic Geometry & Calculus II	4
ENG 111 Composition & Rhetoric	3	CH 107 Principles of Chemistry	4
MA 102 Analytic Geometry & Calculus I	4	ENG 112 Composition & Reading	3
Humanities Social Sciences	3	Physical Education	1
Physical Education	1		16
	16		

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PY 202 General Physics	4	PY 203 General Physics	4
MA 202 Analytic Geometry & Calculus III	4	PY 413 Thermal Physics	3
Free Elective	2	MA 301 Applied Differential Equations I	3
Humanities Social Sciences	3	Free Elective	3
English Elective	3	Humanities Social Sciences	3
Physical Education	1	Physical Education	1
	17		17

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PY 411 Mechanics I	3	PY 412 Mechanics II	3
PY 414 Electricity & Magnetism I	3	PY 415 Electricity & Magnetism II	3
PY 451 Intermediate Experiments in Physics I	2	PY 452 Intermediate Experiments in Physics II	2
MA 401 Applied Differential Equations II	3	Mathematics Elective	3
Free Elective	3	Humanities-Social Sciences	3
	14	Free Elective	3
			17

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PY 101 Modern & Quantum Physics I	3	PY 402 Modern & Quantum Physics II	3
Technical Elective*	3	Technical Electives*	6
Mathematics Elective	3	Humanities Social Sciences	3
Humanities Social Sciences	3	Free Electives	3
Free Elective	3		13
	15	Hours Required for Graduation	127

* Technical or Sciences Electives (above 200 level)

STATISTICS

Cox Hall

Professor D. D. Mason, Head of the Department

Professor F. E. McVay, Coordinator of Advising

Professors: B. B. Bhattacharya, C. C. Cockerham, F. G. Giesbrecht, H. J. Gold, M. M. Goodman, A. H. E. Grandage, R. J. Hader, W. L. Haffey, D. W. Hayne, T. Johnson, A. R. Manson, R. J. Monroe, L. A. Nelson, C. H. Pructor, C. P. Quisenberry, J. O. Rawlings, D. L. Ridgeway, J. A. Rigney, R. D. G. Steel, H. R. van der Vaart, J. L. Wasik, O. Wesler. *Adjunct Professors:* A. L. Finkner, J. T. Wakeley. *Associate Professors:* A. R. Gallant, T. M. Gerig, A. C. Linnerud. *Visiting Associate Professor:* B. S. Weir. *Adjunct Associate Professors:* E. L. Battiate, D. L. Bayless, J. R. Chromy, H. T. Schreuder. *Assistant Professors:* D. D. Boos, D. A. Dickey, E. J. Dietz, H. J. Kirk, J. L. Monahan, T. W. Reiland, B. J. Stines. *Adjunct Assistant Professors:* A. J. Barr, J. H. Goodnight. *Instructor:* A. F. Benford. *Associate Statisticians:* S. B. Donaghy, H. K. Hamann, D. W. Turner, M. Wann. *Assistant Statisticians:* J. S. Mills, F. T. Wang

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 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 schools at North Carolina State University including the Agricultural Experiment Station. 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 such fields as the physical, biological and social sciences, and in industrial research and development.

The undergraduate program leads to a bachelor of science in statistics. See listing of graduate degrees offered and consult the Graduate Catalog for information on the graduate programs.

OPPORTUNITIES

The importance of sound statistical thinking in the design and analysis of quantitative studies is generally recognized. 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 experimental and survey data, the statistician is in demand wherever quantitative studies are conducted.

STATISTICS CURRICULUM

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
CH 101 General Chemistry I	4	CH 103 General Chemistry II	4
MA 102 Analytic Geometry and Calculus I	4	MA 201 Analytic Geometry and Calculus II	4
CSC 101 Introduction to Programming	3	BS 100 General Biology	4
Physical Education	1	Physical Education	1
	15		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ST 371 Intro. to Probability and Distribution Theory	2	ST 372 Intro. to Statistical Inference and Regression	2
MA 202 Analytic Geometry and Calculus III	4	MA 405 Introduction to Linear Algebra and Matrices	3
PY 205 General Physics	4	PSY 300 Introduction to Psychology	3
EB 201 Economics I	3	PY 203 General Physics	4
Humanities or Social Science Elective	3	EB 202 Economics II	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>
ST 421 Introduction to Mathematical Statistics	3	ST 422 Introduction to Mathematical Statistics	3
Major Elective	3	Major Elective	6
Foreign Language	3	Foreign Language	3
Humanities or Social Science Elective	3	Free Elective	3
Biological Science Elective	3		15
Free Elective	3		
	18		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
ST 501 Basic Statistical Analysis	3	ST 502 Basic Statistical Analysis	3
Major Elective	3	Major Elective	3
ENG 321 Communication of Technical Information	3	SP 110 Public Speaking	3
Humanities or Social Science Elective	3	Humanities or Social Science Elective	3
Free Elective	3	Free Elective	3
	15		15
		Hours Required for Graduation	127

SCHOOL OF TEXTILES

Nelson Textile Building and David Clark Laboratories

D. W. Chaney, *Dean*

D. S. Hamby, *Associate Dean, Textiles Extension and Continuing Education*; M. R. Shaw, *Assistant Dean, Textiles Research*; P. D. Emerson, *Head, Textile Machine Design and Development*; W. E. Smith, *Assistant to the Dean, Student Services*; E. E. Hutchison, *Academic Coordinator*; G. Rodeffer, *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 and in household and apparel uses. These versatile materials—textiles—are made to exacting 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; it carries through a myriad selection of processes for fabric formation, including the steps necessary to make fabrics useful, such as the manufacture of dyestuffs and coloring, chemical auxiliaries and finishes, cutting and fashioning into end-use products.

The approximately 5,000 graduates of the School of Textiles hold diverse positions, mostly in North Carolina. In the textile and related industries, occupations range from manufacturing management, sales, corporate management, designing and styling, research development and technical service to 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 and machines. 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 the 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 School of Textiles prepares young people for careers in the above occupations. A broad background is stressed; two-thirds of the educational program can come from the resources of the University outside the School. Opportunities remain excellent, with the School maintaining one of the University's best placement records. Demand for textile graduates from North Carolina State University is particularly strong, due in part to the strength of the academic programs. These programs are organized in two departments: textile materials and management and textile chemistry.

CURRICULA

The School of Textiles offers a broad choice of curricula depending upon individual interests. Terminal Bachelor of Science programs in textiles, textile management, textile science or in textile chemistry permit a broad choice of courses in addition to required core courses. For example, a student may specialize in yarn or fabric structures, in textile economics and marketing or in fabric styling and design. The student's curriculum includes humanities, social sciences and basic sciences and may include a concentration in business economics, industrial engineering, mathematics, physics, chemistry, computer science, statistics or textile chemistry (or technology). The structure of the course sequence may allow graduate study in either the field of concentration or in the textile major. It is possible, with one semester or less of extra work, to obtain a double degree, for example in textiles and textile chemistry.

Curricula leading to graduate study, particularly to Doctor of Philosophy programs, such as in fiber and polymer science, differ from terminal Bachelor of Science programs primarily in the junior and senior year. While considerable latitude is still possible, there are a number of prescribed courses, the nature of which depends upon the type of graduate study anticipated.

Textile chemistry gives the student fundamental education in chemistry emphasizing the application of this science to textiles. Emphasis on chemical fundamentals adequately

prepares exceptional textile chemistry students for graduate study either in pure or applied chemistry. Similarly, students who complete degree programs in textiles, textile management or textile science with a high degree of excellence may do graduate study in numerous areas.

Inasmuch as professional textiles work 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 School of Textiles with a minimum loss of time.

INSPECTION 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 school placement office and frequently can be arranged in the student's home community. Qualified students may arrange to receive academic credit for faculty-approved summer jobs.

DEGREES

Upon completion of programs in either textiles, textile management, textile science or textile chemistry, the degree of Bachelor of Science is conferred.

The School of Textiles offers the following graduate degrees: Master of Textiles; Master of Science in textiles or in textile chemistry; and Doctor of Philosophy in fiber and polymer science. For general requirements consult the Graduate Catalog.

By faculty agreement candidates for the Doctor of Philosophy degree in other schools of this institution may specialize in essentially textile-related subjects. In such cases, research is usually done in textiles.

FOUR-ONE PROGRAM

The School 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 management, textile science or textile chemistry after the satisfactory completion of one year of study.

Applicants should have completed basic business economics, mathematics, physics and chemistry comparable to that required in all of the basic textile curricula. Under these conditions, the student can complete the degree requirements in two regular semesters and summer school. Students not meeting minimum requirements in sciences or applied mathematics could remove deficiencies in the summer session prior to the fall semester, allowing completion of studies at the end of the normal period or in the following summer sessions.

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 penetrate deeply into an area of special interest with exposure to various forms of research or independent study. Academically-promising entrants to the School, and students who develop academic promise 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 and reveal 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 honors adviser 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 or minimums of textile content. In the junior and senior years 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.

FACILITIES

The Nelson Textile Building and David Clark Laboratories house one of the most modern, best equipped textile institutions. Included is the Burlington Textiles Library, a division of the D. H. Hill Library and one of the country's most complete textile libraries.

SPECIAL SERVICES

The School of Textiles offers a number of services and programs which enriches its academic programs.

Textile Research is conducted on a wide variety of problems including some concerns of society with the environment and with health and safety. 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 engaged in by all faculty. It serves the needs of the textile industry by 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.

Machine Design and Development, including well equipped shops, provides engineering assistance to the faculty and students. This department endeavors to remain current with recent engineering advances applicable to textiles and maintains active liaison with industry and the scientific community.

The Office of Student Services is responsible for the placement and financial aid programs of the School of Textiles. The placement function makes available to a potential employer the credentials of our students for permanent and summer employment and in a great number of cases performs equally for alumni.

The financial aid function operates by committee and makes it possible for any North Carolina student to pursue an education in textiles through scholarships, loans or grants as long as one maintains the University's academic and moral standards.

TEXTILE CHEMISTRY

David Clark Laboratories

Professor W. M. Whaley, Head of the Department

Associate Professor C. D. Livengood, Coordinator of Advising

Professors: D. M. Cates, J. A. Cuculo, R. D. Gilbert, B. McGregor, W. K. Walsh, Adjunct Professors: Kurt Dellian, H. F. Mark, A. Schindler, A. A. Volpe, Associate Professors: T. H. Guion, M. H. Theil, C. Tomasino, Adjunct Associate Professor: T. Murayama, Assistant Professors: G. N. Mock, Adjunct Assistant Professors: L. A. Graham, W. R. Martin Jr., Instructor: J. W. Rucker

The field of textile chemistry embraces a number of disciplines and is concerned, in part, with those industrial processes that constitute the final steps in the preparation of textile materials for the consumer. Common terms applied to these processes are scouring, bleaching, printing, dyeing and finishing. Textile chemistry is also concerned with fiber-forming polymers, both natural and man-made, and how the chemical and physical properties of such materials vary with fiber structure. Students receive a fundamental knowledge of the underlying principles that relate to this derivative field and a perspective that includes the many interacting factors involved in the preparation and conversion of polymeric materials to useful products.

FACILITIES

David Clark Laboratories houses offices, classrooms, laboratories and pilot facilities for instruction and research. The departmental radiation laboratory is in Nelson Building. Radiation facilities include a Cobalt 60 source and a 500 KV Electron Accelerator.

Equipment is available for ultra-violet, visible, infrared, nmr and esr spectroscopy, reflectometry, colorimetry, viscometry, chromatography, differential thermal analysis, thermal gravimetric analysis, differential scanning calorimetry, instrumental measurement of color and computer color matching. Common testing equipment used for the evaluation of the physical properties of textile materials and for determining the color fastness, wash fastness, etc., of fibers and fabrics is also available. Complete pilot plant facilities allow demonstration of wet-processing operations used in textiles.

CURRICULA

The department has three undergraduate curricula: (a) Dyeing and Finishing Operations, (b) Dyeing and Finishing Science, and (c) Polymer Chemistry. The first concentration is primarily for students who wish a terminal Bachelor of Science degree, whereas the other concentrations are oriented toward advanced studies. However, the student taking Dyeing and Finishing Operations can use elective courses to achieve a background suitable for graduate studies if he wishes to do so.

See listing of graduate degrees offered and consult the Graduate Catalog.

CURRICULA IN TEXTILE CHEMISTRY (B.S. in Textile Chemistry)

A. Dyeing and Finishing Operations Concentration

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 101H Textile Concepts	1	T 203 Intro. to Pol. Chem.	3
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
CH 101 Gen. Chemistry I	4	CH 107 Principles Chem.	4
MA 112 Anal. Geom. Calc A	4	MA 212 Anal. Geom. Calc B	3
Physical Education	1	Physical Education	1
Humanity-Social Sci. Elect.	3		14
	16		

SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 301 Tech Dyeing Finish	4	TC 903 Textile Chem. I	2
CH 221 Organic Chem I	4	T 315 Intro. Color Sci.	1
T 250 Fabric Forming Syst.	3	CH 223 Organic Chem II	4
or		PY 211 General Physics	4
T 220 Yarn Forming Syst.	1	Humanity Soc. Science Elect.	3
T 211 Intro. to Fiber Sci.	3	Free Elective	3
Physical Education	1	Physical Education	1
	15-16		18

JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TC 461 Intro to Fib Form Pol.	3	Phys. Chem Thermo Elect ****	4
T 220 Yarn Forming Syst.	1	TC 404 Text. Chem. Tech.	3
or		TC 406 Text. Chem. Terh. Lab	2
T 25 Fabric Forming Syst.	3	TC 112 Text Chem Analysis II	3
TC 403 Text Chem Tech	3	Humanity-Social Sci. Elective	3
TC 105 Text Chem Text. Lab	1	Free Elective	3
PY 212 General Physics	4		18
Humanity Soc. Science Elect.	3		
	17-18		

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
PAMS Elective**	2-4	PAMS Elective**	3-4
Text. Chem. Elect.*	6	Textile Chem. Elective*	3
Textiles Elective***	3	Textiles Electives	1-3
Humanity-Social Science Elect.	3	Humanity-Social Science, Elec.	3
	14-16	Free Elective	3
			13-16

Hours required for graduation129

- * Textile Chemistry Electives: 9 hrs. From following:
T 401; TC 490; TC 491; TC 561; TC 562; TC 569; TC 591; T 402
- ** PAMS Electives: 5-8 hrs. from following or related courses:
MA 114; MA 301; CH 315; ST 961; CSC 111; CSC 200 or CSC 101 + CSC 251
- *** Textile Electives. 4-6 hrs. from any TC, TX or T courses in 300-500 level.
- **** Physical Chemistry/Thermodynamics elective: either CHE 205 or CH 331.

Note: (1) any course listed in Dyeing and Finishing Science or Polymer Chemistry may be substituted for required courses in Dyeing and Finishing Operations in the same subject and at the same level. *Example* MA 102 for MA 112 or PY 205 for PY 211.

(2) any student wishing Textile Management training is encouraged to select from the following list of courses for the 4-6 hours designated for textile elective courses:

TX 380	TX 482	TX 381
TX 480	TX 484	TX 487

B. Dyeing and Finishing Science Concentration

FRESHMAN YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 101H Textile Concepts	1	T 203 Intro. to Pol. Chem.	3
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
CH 101 Gen. Chemistry I	4	CH 107 Principles Chem.	4
MA 102 Anal. Geom. Calc. I	4	MA 201 Anal. Geom. Calc. II	4
Physical Education	1	Physical Education	1
Humanity-Social Sci. Elect.	3		15
	16		

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 301 Tech. Dyeing Finish	4	TC 303 Textile Chemistry I	2
CH 221 Organic Chem. I	4	T 305 Intro. Color Science	1
MA 202 Anal. Geom. Calc. III	4	CH 223 Organic Chem. II	4
T 250 Fabric Form. System	3	PY 205 General Physics	4
Physical Education	1	MA 301 Appl. Diff. Equat. I	3
Free elective	3	T 211 Intro. to Fiber Science	3
	19	Physical Education	1
			18

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TC 461 Intro. to Fib Form Pol	3	Phys. Chem./Thermo. Elect.****	3
Dyeing Finishing Elective**	4	Dyeing Finishing Elect. **	5
PY 208 General Physics	4	Humanity-Social Sci. Elect.	3
T 220 Yarn Form System	4	Free Elective	3
Phys. Chem./Thermo. Elect.****	3-4		14
	18-19		

SENIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Dyeing Finishing Elect.**	3	Polymer Chem. Elect.***	3
Polym. Chemistry Elective***	3	Textiles Elective #	1-4
Humanity-Social Sci. Elect.	6	Humanity-Soc. Sci. Elect.	6
PAMS Elective*	2-4	Free Elective	3
	14-16		13-16

Hours required for Graduation 130

Restricted electives in

* PAMS 2-4 credits from the following:

CSC 111	2
CH 315	4
ST 361	3
CSC 101 + CSC 251	4

** Dyeing and Finishing 9 credits from the following:

T 401	3	TC 405	2
TC 403	3	TC 412	3
TC 404	3	TC 505	3
TC 405	1	T 506	3

Three additional credits from the list above or the following:

TC 490	1-6
TC 491	1
TC 591	3

*** Polymer Chemistry 6 credits from the following:

T 402	3	TC 569	3
TC 504	3	TC 591 (Polymer Lab Course)	3
TC 561	3	TX 460	3
TC 562	3		

**** Physical Chemistry/Thermodynamics—6 credits from the following:

CH 431	3	CH 431	3	CHE 205	4
CH 433	3	CH 496 (Physical Chemistry)	3	CHE 316	3
	6		6		7

#Textiles 1-4 credits in TC, TXT or T courses at 300-500 level (including any elective course in dyeing and finishing or polymer chemistry listed above).

C. Polymer Chemistry Concentration

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 101H Textile Concepts	1	T 203 Intro. to Pol. Chem.	3
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
CH 101 Gen. Chemistry I	4	CH 107 Principles Chem.	4
MA 102 Anal. Geom. Calc. I	4	MA 201 Anal. Geom. Calc. II	4
Physical Education	1	Physical Education	1
Humanity-Soc. Sci. Elect.	3		
	16		15

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 301 Tech. Dyeing Finish.	4	TC 303 Textile Chem I	2
CH 221 Organic Chem. I	4	T 305 Intro. Color Science	1
MA 202 Anal. Geom. Calc. III	4	CH 223 Organic Chem. II	4
T 250 Fabric Form. System	3	PY 205 General Physics	4
Physical Education	1	MA 301 Appl. Diff. Equat. I	3
Free Elective	3	T 211 Intro. to Fiber Sci.	3
	19	Physical Education	1
			18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TC 461 Intro to Fib-Form Pol.	3	Phys. Chem./Thermo. Elect.****	3
PY 208 General Physics	4	PAMS Elective*	2-4
T 230 Yarn Form. System	4	Polymer Chem. Elect.***	3
Phys. Chem./Thermo Elect****	3-4	Humanity-Soc. Sci. Elect.	3
	14-15	Free Elective	3
			14-16
			201

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
Dyeing Finishing Elective**	3	Polymer Chem. Elect.***	3
Polymer Chemistry Elective***	6	Textiles Elective #	1-4
Humanity-Soc. Sci. Elect.	6	Humanity-Soc. Sci. Elect.	6
Free Elective	3	Dyeing Finishing Elect **	3
	18		13-16
		Hours required for Graduation	130

Restricted electives in

- * PAMS 2-4 credits from the following

CSC 111	2
CH 315	4
ST 361	3
CSC 101 + CSC 251	4
- * Dyeing and Finishing 6 credits from the following

T 401	3	TC 406	2
TC 103	3	TC 505	3
TC 404	3	TC 591	3
TC 405	1	T 606	3
		TC 412	3
- *** Polymer Chemistry electives: nine credits from the following:

TC 591	3	TX 460	3
TC 561	3	T 402	3
TC 562	3	TC 591 (Polymer Lab Course)	3
TC 569	3		
- Three additional credits from either the list above or the following:

TC 490	1-6
TC 491	1
TC 591	3
- **** Physical Chemistry Thermodynamics 6 credits from the following:

CH 431	3	OR	CH 431	3	OR	CHE 205	4
CH 433	3		CH 485 (Physical Chemistry)	3		CHE 316	3
				6			7

#Textiles 1-4 credits in TC TXT or T courses at 300-500 level (including any elective course in dyeing and finishing or polymer chemistry listed above)

TEXTILE MATERIALS AND MANAGEMENT

Nelson Textile Building

Professor D. R. Buchanan, Head of the Department

Associate Professor E. E. Hutchison, Academic Coordinator

Associate Professor M. L. Robinson Jr., Coordinator of Freshman Advising

Professors: A. H. El Shuekh, T. W. George, D. S. Hamby, S. P. Hersh, P. R. Lord, M. H. Mohamed; *Associate Professors:* S. K. Batra, G. A. Berkstresser, C. L. Dyer, R. E. Fornes, P. L. Grady, B. S. Gupta, J. J. F. Knapton, W. C. Stuckey Jr., P. A. Tucker; *Adjunct Associate Professors:* V. F. Holland, J. C. Lumsden, N. C. Morosoff, D. M. Powell, P. E. Sasser, M. W. Suh; *Assistant Professors:* R. A. Donaldson, L. T. Lassiter, F. W. Massey, H. M. Middleton Jr.; *Instructors:* A. C. Clapp, Peter Schwartz, G. W. Smith; *Lecturer:* T. R. Rhodes

The Department of Textile Materials and Management instructs students in the theory and fundamental concepts of fiber properties and fiber processing into yarns, fabrics and end-products. This is accomplished through the systematic study both of the basic properties of the materials being processed and of the processes involved. The department is engaged in research supported by University funds and industrial and governmental sponsors. Faculty, graduate and undergraduate students (through the Honors program) may participate in the research program.

CURRICULA

The department has three baccalaureate degree programs each with its individual curriculum: (a) Textiles, (b) Textile Management, and (c) Textile Science. In the first two years all curricula are concerned primarily with physical sciences, humanities, social sciences and basic studies in textile fundamentals. Students elect the particular degree program they wish to follow during the sophomore year although a tentative selection may be made during the freshman year. All three curricula provide a broad educational background while preparing the graduate for a rewarding career in textiles.

The Textiles curriculum is designed to provide a broad foundation in general textiles including fiber, yarn and fabric technology. Areas of concentration include apparel manufacturing and management, textile operations, textile design (under development), or a planned program in other science-oriented disciplines.

The Textile Management curriculum combines a foundation both in textiles and in management principles and applications. Management electives include a sequence of courses in production analysis, labor management, business law, accounting, data processing/production control, management science or finance/investment.

The Textile Science curriculum is based on a foundation both in textiles and science. Science electives are designed to give a greater science base in one or more areas such as mathematics, chemistry, physics, computer science, engineering science and materials, textile chemistry or advanced textiles.

All three curricula provide opportunity for the student to prepare for graduate studies in textiles or other disciplines. For example, graduates of the Textile Management curriculum have the opportunity of entering masters programs in management or textile management while graduates of the Textile Science curriculum have opportunity to enter graduate programs for the M.S. and Ph.D. degrees.

See listing of graduate degrees offered.

FACILITIES

The Department of Textile Materials and Management is located in the Nelson Textile Building. The building houses offices, classrooms and laboratories for instruction and research. The laboratory areas include facilities for processing short and long staple natural and synthetic fibers, throwing and texturing continuous filament yarns, study of the formation of various woven, knitted and nonwoven fabrics and yarn preparation systems. The department has extensive facilities for physical testing of fiber, yarns and fabrics; a textile physics laboratory includes equipment designed for specialized textile problems, such as dynamic, sonic and electrostatic studies.

CURRICULA IN TEXTILE MATERIALS AND MANAGEMENT

B.S. DEGREE IN TEXTILES

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 101 Textile Concepts	1	T 220 Yarn Forming Syst.	4
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp & Reading	3
CH 101 Gen. Chemistry I	1	T 203 Introd to Polymer Chem. or Technical Elective**	3
Humanity/Social Sci. Elect	3	MA 212 Anal. Geom. & Calc. B or MA 201 Anal. Geom. & Calc. II	3.4
MA 112 Anal. Geom. & Calc. A or MA 102 Anal. Geom. & Calc. I	4	Physical Education	1
Physical Education	1		
	16		14-15

SOPHOMORE YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 250 Fabric Form Syst.	3	Technical Elective** or	
T 211 Intro. to Fiber Sci. or		T 211 Intro. to Fiber Sci.	3
T 203 Intro. to Polymer Chem.	3	TX 320 Mech. Sp. Yn Mfg. Syst.	4
PY 211 (or 205) Gen. Physics	4	PY 212 (or 208) Gen. Physics	4
CSC 200 Intro to Computers	3	TX 341 Knitting Syst.	3
Humanity/Social Sci.*	3	ST 361 Intro. to Statistics for Engineers	3
Physical Education	1	Physical Education	1
	17		18

JUNIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 301 Tech of Dye & Finish	4	TX 330 Text. Meas. & Qual. Cont.	4
TX 305 Dir Fiber to Fab. Prod.	2	TX 370 Tech. Fabric Design	4
TX 351 Weaving Syst.	3	TX 380 Mgmt & Cont of Text. Syst.	3
TX 425 Text Yarn Prod. & Prop.	3	TX Concentration***	3
Humanity/Social Sci.*	3	Technical Elective**	3
Free Elective	3		17
	18		

SENIOR YEAR

<i>Full Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TX 460 Phy. Prop. of Text Fib.	3	TX Concentration***	6
TX Concentration***	6	Humanity/Social Sci. Elect.*	6
Humanity/Social Sci. Elect.*	3	Free Elective	3
Free Elective	3		15
	15	Minimum Hours for Graduation	130

Electives and Concentrations

- * **Humanity/Social Science Electives** 18 hours in addition to ENG 111 & 112
Six hours of these courses are specified: EB 201, Economics I, and a course in communications, such as ENG 321, The Communication of Technical Information, or speech courses such as SP 110, Public Speaking, and SP 112, Interpersonal Communication. Students are encouraged to distribute the remaining Humanities/Social Science courses in different areas, such as Anthropology, History, Philosophy, Religion, Economics, Political Science, Sociology Psychology, University Studies, etc.

- ** **Technical Electives**—6 or more hours to enlarge science base.

Suggested Courses (check prerequisites)

- Chemistry CH 103(4), 105(3), 107(4), 220(4)
- Mathematics—MA 202(4), 301(3)
- Industrial Engr. IE 301(3), 332(4), 352(3)
- Computer Science a 200 level programming course (CSC)
- Materials Engr. MAT 201(3)
- Engr. Science & Mech.—ESM 200(3)

- *** **Textile Concentration (Restricted Electives)** 15 hours

The concentration hours are designed to allow students to develop specific areas of interest in textiles or related areas. Two concentrations have been planned; however, a third, Textile Design, is still under development.

(1) **Textile Operations**

Selection of courses in this concentration will come from the following group. Nine credit hours will be selected from one group either yarn mfg., fabric mfg., or qual. cont., and 6 additional hours from any of the remaining groups.

<i>Furn. Mfg.</i>	<i>Fabric Mfg.</i>	<i>Qual. Cont.</i>	<i>Text. Chem.</i>
TX 420 3	TX 405 3	TX 431 3	CH 220 4
TX 426 3	TX 441 3	TX 530 3	TC 303 2
TX 480 3	TX 442 3	TX 490 3	TC 403 3
TX 490 3	TX 443 3	TC 412 3	TC 405 1
TX 520 3	TX 449 3	T 500 3	TC 404 3
	TX 450 3	IE 332 3	TC 406 2
	TX 451 3		
	TX 480 3		
	TX 490 3		

(2) *Apparel Manufacturing and Management*

Concentration hours will include those courses required by the cooperative agreement between the School of Textiles and Fashion Institute of New York or Southern Technical Institute of Marietta, Ga. These courses will be taken during the junior year at either FIT or Southern Tech. requiring that the student be away from NCSU equivalent to one semester and one summer session or possibly two semesters.

(3) Students interested in textile design or science oriented disciplines other than the above may elect to take these 15 hours of concentration in those areas in a planned program if it meets with the approval of the Department Head.

B.S. DEGREE IN TEXTILE MANAGEMENT

FRESHMAN YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 101 Textile Concepts	1	T 220 Yarn Form. Syst.	4
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
CH 101 Gen. Chemistry I	4	T 203 Intro. to Polymer Chem	3
MA 112 Anal. Geom. & Calc. A or		MA 212 Anal. Geom. & Calc. B or	
MA 102 Anal. Geom. & Calc. I	4	MA 201 Anal. Geom. & Calc II	3-4
Humanity/Social Sci. Elect.*	3	Physical Education	1
Physical Education	1		14-15
	16		

SOPHOMORE YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 250 Fabric Form. Syst.	3	TX 380 Mgmt. Cont. Text. Syst.	3
T 211 Intro. to Fiber Sci.	3	TX 341 Knitting Syst.** or	
EB 201 Economics I	3	TX 320 Mech Sp. Vs. Manf. Syst.**	3-4
PY 211 (or 208) Gen. Physics	4	ACC 262N Man Uses Cost Data	3
Humanity/Social Sci. (SP 110 or		PY 212 (or 208) Gen. Physics	4
211)*	3	Humanity/Social Sci. (ENG 321)*	3
Physical Education	1	Physical Education	1
	17		17-18

JUNIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 301 Tech. Dye. & Finish.	4	TX 405 Non-Conv. Fab. Struct.** or	
TX 351 Weaving Syst.**	3	TX 330 Text. Meas. & Qual. Cont.**	3-4
EB 301 Production & Prices	3	EB 302 Agg. Econ. Anal.:	
ST 361 Intro. to Statistics	3	Theory and Policy	3
CSC 111 Intro. to Fortran Programming or		EB 313 Marketing Methods	3
CSC 300 Intro. to Computers	2-3	EB 420 Corporation Finance	3
Free Elective	3	Management Elective***	3
	18-19		15-18

SENIOR YEAR			
<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TX 460 Phy. Prop. of Tex. Fib.**	3	TX 484 Mgmt. Dec. Mak Text. Firm.	3
TX 480 Textile Cost. Control	3	Humanity/Social Sci. Elect.*	6
TX 482 Sales Mgmt. for Text.	3	Management Elective***	3
Humanity/Social Sci. Elect.*	3	Free Elective	3
Management Elective***	3		15
Free Elective	3	Minimum Hours for Graduation	130
	18		

Electives

* *Humanity-Social Science Electives* 18 hours in addition to ENG 111 & 112

This curriculum specifies that six of these hours be courses in communications; specifically ENG 321, The Communication of Technical Information, and SP 110, Public Speaking, or SP 211, Argumentation and Debate. Students are encouraged to distribute the remaining Humanities/Social Science courses in different areas such as Anthropology, History, Philosophy, Religion, Economics, Political Science, Sociology, Psychology, University Studies, etc.

** *Textiles Electives*—12 (14) hours:

Students have the option of selecting any four courses from the following courses noted on the sample curriculum:

TX 320	4	TX 351	3
TX 330	4	TX 405	3
TX 341	3	TX 460	3

*** *Management Electives*—9 hours

The management component of this curriculum is expanded beyond the core of 18 hours of economics/accounting courses and 12 hours of textile management courses (TX 380, 480, 482, 484) by the 9 hours of management electives. The management electives consist of a sequence of courses in production analysis, labor management, business law, accounting, data processing/production control, management science mathematics, or finance/investment. Elective sequence of courses are as follows:

Production Analysis

IE 332	4
IE 352	3
IE 432	3
or	
IE 443	3

Labor Management

EB 326	3
or	
EB 332	3
IE 555	3
TX 487	3

Business Law

EB 307	3
EB 308	3
TX 487	3

Accounting

9 hours of ACCN courses to be determined

Data Processing/Production Control

IE 307	3
IE 352	3
IE 421	3

Management Science Math

MA 202	4
MA 301	3
MA 405	3
MA 421	3
MA 522	3
ST 421	3

Finance/Investment

EB 404	3
EB 422	3
IE 311	3

B.S. DEGREE IN TEXTILE SCIENCE

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 101 Textile Concepts	1	T 220 Yarn Form. Syst.	4
ENG 111 Comp. & Rhetoric	3	ENG 112 Comp. & Reading	3
CH 101 Gen. Chemistry I	4	CH 103 Gen. Chemistry II or	
MA 102 Anal. Geom. & Calc. I	4	CH 107 Prin. of Chemistry	4
Humanity/Social Sci. Elect.*	3	MA 201 Anal. Geom. & Calc. II	4
Physical Education	1	Physical Education	1
	16		16

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
T 250 Fabric Form. Syst.	3	T 301 Tech. of Dye. & Finish.	4
T 203 Introd. to Polymer Chem.	3	T 211 Introd. to Fiber Sci.	3
PY 205 Gen. Physics	4	PY 208 Gen. Physics	4
MA 202 Anal. Geom. & Calc. III	4	MA 301 App. Diff. Equations I or	
Humanity/Social Sci. Elect.*	3	MA 405 Intro. to Lin. Alg. & Mat.	3
Physical Education	1	Free Elective	3
	18	Physical Education	1
			18

JUNIOR YEAR

<i>Fall Semester</i>	<i>Credits</i>	<i>Spring Semester</i>	<i>Credits</i>
TX 420 Mod. Dev. Yn. Mfg. Syst.** or		TX 330 Text. Meas. & Qual. Cont.	4
TX 320 Mech. Sp. Yn. Mfg. Syst.**	3-4	TX 405 Non-Conv. Fabric Struct.** or	
TX 341 Knitting Syst.** or		TX 351 Weaving Syst.**	3
TX 351 Weaving Syst.**	3	Restricted Electives***	6
ST 361 Intro. to Statistics	3	Humanity/Social Sci. (ENG 321)*	3
CSC 111 Intro. to Fortran Programming	2		16
Restricted Electives***	5		
	16-17		

SENIOR YEAR

Full Semester	Credits	Spring Semester	Credits
TX 460 Phy. Prop. of Text. Fib.	3	TX 425 Text. Yn. Prod. & Prop.** or	
Restricted Elective***	3	TX 420 Mod. Dev. Yn. Mfg. Syst.**	3
Humanity/Social Sci. Elect.*	6	Restricted Electives***	6
Free Elective	3	Humanity/Social Sci. Elect.*	3
	15	Free Elective	3
			15

Minimum Hours for Graduation130

Electives

* *Humanity/Social Science Electives*—18 hours in addition to ENG 111 & 112.

This curriculum specifies that three of these hours be ENG 321, The Communication of Technical Information. Students are encouraged to distribute the remaining Humanities/Social Science Courses in different areas such as Anthropology, History, Philosophy, Religion, Economics, Political Science, Sociology, Psychology, University Studies, etc.

** *Textile Electives* 12(13) hours

Students have the option of selecting four courses, two from each grouping shown.

a.

TX 320	4
TX 420	3
TX 425	3

b.

TX 341	3
TX 351	3
TX 405	3

** *Restricted Electives* 20 hours

The restrictive electives are designed to give the student a greater science base in one or more areas. The 20 hours will be chosen from two or more of the groups of courses listed below. Maximum of 12 hrs. allowed from group F.

A	D	F
<i>Math & Statistics</i>	<i>Computer Science</i>	<i>Advanced Textiles and Operations</i>
MA 401 .....3	CSC 101 .....3	T 402 .....3
MA 421 .....3	CSC 102 .....3	T 500 .....3
MA 427 .....3	CSC 201 .....3	TC 461 .....3
ST 371 .....2	CSC 202 .....3	TC 504 .....3
ST 421 .....3	CSC 251 .....1	TX 560 .....3
ST 422 .....3	CSC 311 .....3	TX 561 .....3
	CSC 411 .....3	TX 480 .....3
	CSC 421 .....3	TX 425 .....3
	CSC 495 .....VAR	TX 443 .....3
		TX 450 .....3
		TX 520 .....3
		TX 541 .....3
		TX 549 .....3
		TX 555 .....3
		TX 431 .....3
		TX 530 .....3
		or IE 443 .....3
		IE 546 .....3
		TC 412 .....3
		ST 371 .....2
		ST 421 .....3
		ST 422 .....3
		EB 301 .....3
		EB 302 .....3
		EB 451 .....3
		IE 328 .....3
		or 351 .....3
		IE 332 .....4
		IE 401 .....3
		TX 380 .....3
		TX 484 .....3
		TX 585 .....3
		OR 501 .....3

C
Physics

PY 245	3
PY 401	3
or 407	3
PY 402	3
PY 411	3
PY 412	3
PY 413	3
PY 414	3
PY 415	3



In addition to a broad range of academic programs encompassing more than 80 fields of study, the University also offers a rich program of cultural performances during the year.

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. (On cross-listed 500-level courses, refer to respective cross-listing for prerequisites corequisites.) Within each of the prefix groups, the course descriptions are arranged by course number: numbers 100-299 are courses intended primarily for freshmen or sophomores; numbers 300-499 are courses intended primarily for juniors or seniors; numbers 490-498 are seminar, project, or special topics courses; number 499 is for undergraduate research.

This list contains all undergraduate courses, 100-level through 400-level, approved at the beginning of the 1978 Fall 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) which students are expected to have completed successfully (or attained) prior to enrolling in a course. Waiver of prerequisites is at the discretion of the instructor. Corequisites are courses which should be taken concurrently by students who have not previously completed the corequisite. Some courses also have restrictive statements, such as "Credit in both MA 102 and MA 112 is not allowed." Consent of the department is required for all practicum and in dividual special topics or special problems courses as well as internships and thesis or disser tation research.

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 up 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 nor mally offered in the Fall Semester, S indicates the Spring Semester, Sum. indicates the Sum mer Terms, and 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.

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AGRICULTURAL INFORMATION

AC 311 Communication Methods and Media. Preq: ENG 112. 3(3-0) S. Written, oral and visual techniques of communications; a survey of the channels of communications available; principles and techniques for using these channels individually or combined into a publicity, promotion, public relations, information or advertising program. Carpenter

ACCOUNTING

(Also see Economics and Business.)

ACC 260 Accounting I Concepts of Financial Reporting. 3(3-0) F,S. Financial reporting concepts, the information generating process, income measurement, resource valuation, corporate equity measurement, reporting practices, and the interpretation and analysis of financial statements. Introduction to internal controls and merchandising and manufacturing inventories. Staff

ACC 261 Accounting II Financial Information Systems. Preq: ACC 260. 3(3-0) F.S. Information systems and their generation of financial data for reporting purposes. Includes consideration of the reporting practices related to noncorporate entities, financial statement structures and classifications, and internal controls. Staff

ACC 262 Managerial Uses of Cost Data. Preq: ACC 260. 3(3-0) F.S. Managerial uses of cost data in planning, controlling, and evaluating organizational activities and in making business decisions. Includes consideration of budgeting, cost behavior, product costing and pricing, and an introduction to production cost. Staff

ACC 360 Financial Reporting Theory and Practice I. Preq: ACC 261. 3(3-0) F.S. The preparation of working papers and financial statements, the valuation and reporting problems relating to cash, receivables, inventories, investments, and tangible and intangible assets. Consideration of related professional pronouncements. Bergold, Brown

ACC 361 Financial Reporting Theory and Practice II. Preq: ACC 360. 3(3-0) F.S. The valuation and reporting problems relating to current and non-current liabilities, and corporate and non-corporate owners' equities. Includes cash and fund-flow reporting, the analysis of financial statements, the impact of price-level changes on financial reporting, and professional literature. Bergold, Brown

ACC 362 Production Cost Analysis and Control. Preq: ACC 262. 3(3-0) F.S. Managerial reporting practices for producing activities, the development and use of cost standards and budgets, and the 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. Brown

ACC 364 An Introduction To Income Taxation. Preqs: ACC 260 and EB 201. A student cannot receive credit for both ACC 364 and 464. 3(3-0) F.S. A conceptually oriented introduction to federal income taxation in its political, social and economic contexts. The primary focus is the individual taxpayer. Additionally, capital gains and losses, and investment incentives are examined. Tax planning and tax research are introduced. Messere, Pinna

ACC 460 Specialized Financial Reporting Theory and Practice. Preq: ACC 361. 3(3-0) F. The specialized valuation and reporting problems relating to consolidated financial statements, business combinations and reorganizations, governmental and nonprofit organizations, home office and branch relationships, foreign affiliates, estates and trusts, and business firms experiencing financial difficulties. Study of related professional publications. Windham

ACC 465 Advanced Income Taxation. Preqs: ACC 360, 364. 3(3-0) S. A second course in federal taxation focusing on the tax treatment of taxpayers other than individuals, and on those property transfers subject to federal and state gift and death taxes. Tax planning—the legal minimization of the tax burden—is emphasized throughout. Tax research methodology is explained and utilized to provide substantive answers to relevant tax problems. Messere, Pinna

ACC 466 Examination of Financial Statements. Preq: ACC 361. 3(3-0) S. The objectives, standards, procedures, problems, practices and theory of financial statement examination as performed by independent public accountants. The professional standards and ethical codes, the features of information systems and internal control, and other professional topics. Extensive use of professional literature and authoritative pronouncements. Bowen

ACC 468 Professional Accountancy Résumé. Preqs: ACC 362 and 460. 3(3-0) S. A review and summation of the theory and practice of financial reporting and professional accountancy, as they relate to preparation for the certified public accountant's examination, covering both their general and specialized topics. Windham

AGRICULTURE AND LIFE SCIENCES

ALS 103 Introductory Topics in the Agricultural and Life Sciences. 1(1-0) F. The scope and objectives of a university education with emphasis on the sciences, particularly as related to biology and agriculture. Guest lectures and departmental programs presented. Craig, Glazener

ALS 299H Honors Seminar. For freshmen and sophomore honor students in SALS (3.0 or better). Enrollment by invitation. 1(1 0) S. A Seminar program for freshman and sophomore honor students in the School of Agriculture and Life Sciences. Topics for discussion are selected by course participants in each section. Topics vary but are generally contemporary issues. Resource persons from the faculty and/or the broader community are included in most discussions.

ALS 400 External Learning Experience. Preqs: Junior standing in SALS and prior arrangement. 1-6 F.S. A learning experience within an academic framework that utilizes facilities and resources that are not available on the campus.

ALS (HSS) 490 International Seminar. Preq: Jrs. and srs., upperclassmen interested in international affairs. 1(1-0) S. A weekly series of seminars on the economic and social aspects of developing countries. Staff

ALS 499H Honors Research. For junior and senior students in SALS who have a GPA of 3.0 or better. Participation is by invitation. 1-3 S. A research program for junior and senior students in the School of Agriculture and Life Sciences. Students work with a faculty member on a research project of mutual interest.

ANIMAL SCIENCE

ANS 200 Introduction to Animal Science. 4(3-2) F.S. The fundamental principles of animal production. The importance of livestock and livestock products in the human diet and in the economy. Goode, Rakes

ANS 204 Livestock Feeds and Feeding. 3(2-2) S. An introduction to applied animal nutrition, including the structure and function of the digestive tract, the nutrient value and classification of feedstuffs and the nutrient requirements and formulation of livestock rations. Leatherwood

ANS (FS, NTR) 301 Nutrition and Man. Preq: Two years of college work. 3(3-0) F.S. (See nutrition.)

ANS 302 Livestock and Dairy Evaluation. 3(2 3) F. Market classes and grades of beef cattle, swine, and sheep are used to study live animal carcass value interrelationships. Breed histories, pedigrees and desirable characteristics of meat and dairy animals are discussed. Umberger, Wilk

ANS 308 Advanced Selection of Dairy and Meat Animals. Preq: ANS 302. 1(0-3) F. Includes intensive practice in selecting market and purebred livestock. Umberger, Wilk

ANS 401 Reproductive Physiology. Preq: ZO 421. 3(2-3) S. Current concepts of physiology related to mammalian reproduction. Emphasis on physiological processes, how they are influenced by external forces and their importance in reproductive performance. Britt

ANS 402 Beef Cattle Management. Preq: ANS 204. 3(2-3) S. Modern management practices emphasizing the application of principles of genetics, ruminant nutrition and animal health to cow-calf programs and to stocker and feeder cattle operations. Harvey

ANS 403 Swine Management. Preq: ANS 204. 3(2-3) F. The economic, nutritional, genetic, physiological and managerial factors affecting the operation of modern swine enterprises. Practices for the commercial producer are emphasized. Laboratory trips are required. Armstrong

ANS 404 Dairy Cattle Management. Preq: ANS 204. 3(2-3) S. A study of practical dairy husbandry and management. Areas include: raising herd replacements, feed production and utilization, breeding and selection, milking procedures, records and housing. Porterfield

ANS 405 Lactation. Preq: ZO 421. 3(2-3) F. Gross and microscopic anatomy of the developing and the mature mammary gland. Physiological processes involved in milk secretion and the removal of milk from the gland. Research problem required. Mochrie

ANS 406 Sheep Management. Preq: ANS 204. 3(2-3) F. The economic, genetic, nutritional, physiological and managerial factors affecting the operation of the modern sheep enterprise. (Offered F 1979 and alt. years.) Goode

- ANS (FS) 409 Meat and Meat Products.** Preq: CH 220. 3(2-3) S. (See food science.)
- ANS 410 Horse Management.** 3(2-2) F. Application of fundamentals of selection, nutrition, breeding and animal health to light horses. Managerial details are covered. Cornell
- ANS 411 Breeding and Improvement of Domestic Animals.** Preq: GN 411. 3(2-2) F. Genetic principles are stressed in relation to the improvement of economically important domestic animals. Emphasis on the specific requirements of breeding plans for individual species. McDaniel
- ANS (NTR, PO) 415 Comparative Nutrition.** Preq. CH 220 or 221. 3(3-0) F. Fundamentals of animal nutrition, including the classification of nutrients; the requirement and general metabolism by different species for health, maintenance, growth and other productive functions. Donaldson, Ramsey
- ANS (VET) 420 Diseases of Farm Animals.** Preqs: CH 101, 103. 3(3-0) S. (See veterinary science.)
- ANS 490 Seminar in Animal Science.** Preq: Senior standing. 1(1-0) S. Discussion of current status of various phases of the livestock industry. Lassiter

Selected 500-Level Courses Open To Advanced Undergraduates

- ANS (PHY) 502 Reproductive Physiology of Vertebrates.** Preq.: ZO 421 or CI 3(3-0) S. Emphasis will be placed on discussions of mechanisms which control the reproductive processes. Mechanisms which are species limited will be compared with those which are shared by all species. Current knowledge of some subsystems will be investigated in detail while others will be referred to in reviews of well-documented research findings. Ulberg
- ANS (GN) 508 Genetics of Animal Improvement.** Preqs.: GN 411, ST 511. 3(3-0) S. Emphasis is placed on the utilization of basic principles of population and quantitative genetics in animal improvement. Factors affecting genic and genotypic frequencies and methods of estimating genetic and nongenetic variance, heritabilities and breeding values are presented. The roles of mating systems and selection procedures in producing superior genetic populations are examined. Robison
- ANS 510 Advanced Livestock Management.** Preq.: ANS 402 or ANS 403 or ANS 404. 3(3-0) S. An advanced study of beef cattle, dairy cattle and swine management practices with particular emphasis on input-output relationships and the consequences of alternative management decisions. Problem. (Offered in even-numbered years.) Davenport
- ANS (NTR) 516 Quantitative Nutrition.** 3(1-6) S. (See nutrition.)
- ANS 520 Tropical Livestock Production.** Preq.: Six hours of ANS at 400-level or CI 3(3-0) S. Modern principles of feeding, genetics, forage production and management are applied to improvement of meat and dairy animals in tropical, subtropical and high-altitude environments. Considers biological and socio-economic constraints to development of livestock industry. Discussion of climatic effects on production applies to U. S. conditions and to developing tropical countries. W. L. Johnson
- ANS (PHY) 580 Mammalian Endocrine Physiology.** Preqs.: BCH 351, ZO 421. 3(3-0) F. Detailed discussion of the mammalian endocrine system with emphasis on the functional aspect, chemistry, and mode of action of specific hormones secreted from major endocrine glands. Modern biochemical and physiological principles of hormonal integrations and neuroendocrine integration are examined. B. H. Johnson
- ANS 590 Topical Problems in Animal Science.** Maximum 6 F.S. Special problems may be selected or assigned in various phases of animal science. Graduate Staff

ANTHROPOLOGY

(Also see Sociology.)

- ANT 251 Physical Anthropology.** 3(3-0) F.S. The evolution of man and his antecedents is illustrated by a study of fossil materials from Africa, Europe and the Far East. The course emphasizes the process of evolution, morphology, classification systems, dating techniques, the beginnings of culture and communication, and human variation, including contemporary races; and increases awareness of man as a culture-bearing primate.

ANT 252 Cultural Anthropology. 3(3-0) F,S,Sum. Through the study of nonliterate peasant and complex societies, an overview is given of the history of ethnological theory, methods in cultural anthropology, ethnographic field-work, personality and culture, the socialization process, cultural ecology, structural functional analysis, language, art and society, kinship systems, political and economic anthropology, religions, magic and witchcraft, and social and cultural change.

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 305 Peoples of the World. 3(3-0) F,S,Sum. Introductory course in ethnology which develops a general understanding of the culture of primitive peoples, peasants, and of modern man. Specific problems are investigated such as cultural ecology, evolution, subsistence practices, nutrition, and economic development.

ANT 310 Indians of North America. Preq: ANT 252 or ANT 305. 3(3-0) F,S. Analysis of North American Indian and Eskimo life, including: 1) theories of provenience and an overview of selected prehistoric cultural manifestations; 2) peoples and cultures at the time of European contact; 3) the nature and concomitants of contacts between native Americans and whites; 4) an examination of contemporary Indian and Eskimo problems relating to identity, accommodation, assimilation and self-determination. (This course will be offered as ANT 405 until Fall, 1979).

ANT 325 Peoples and Cultures of South America. Preqs: Three hours ANT and/or SOC, or HI 215 or HI 216. 3(3-0) F,S. Introduces student to the types of social groups found in South America, and explores the cultural development from prehistoric times to the present. Analyzes problems facing their developing nations from an anthropological point of view, stressing the interrelationships between the national decision-making processes and the small community.

ANT 416 Field Methods in Cultural Anthropology. Preq: Six hours ANT. 3(3-0) F,S. Provides a systematic experience with anthropological field techniques, i.e., community mapping; household census; kinship analysis; life-history recording; participant observation; inventory of material culture; child rearing observation. Familiarizes student with conventional anthropological field tools, i.e., tape recorder, motion picture camera, still camera, fieldwork journal, unstructured interview. Through textbooks and supplementary reading, provides a view of anthropologists' reports of their own field methods and problems encountered.

ANT 420 Biological Bases for Human Social Behavior. Preq: ANT 251, or BS 100 or 105, or GN 301, or equivalent. 3(3-0) S. This course entails an examination of the relevancy and applicability of animal behavior to the study of human social behavior. The nature and uniqueness of human behavior is evaluated in light of what is known about the social behavior of animals, particularly the nonhuman primates.

ANT 498 Special Topics in Anthropology. Preq: Six hours of SOC/ANT 1-6 F,S. A detailed investigation of a special topics in anthropology. The topic and mode of study will be determined by the faculty member(s) and the student. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

ANT 505 Comparative Social Organization. Preq.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0) F. This course will focus on an analysis of forms of social organization in both technologically simple and complex societies from several analytical perspectives. Discussion of kinship theory: the relationship of social organization to systems such as the economic, political, and religious; and an examination of modern development in social organization research will be stressed. Wallace

ANT 508 Culture and Personality. Preq: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0) S. The course focuses on the interplay between cultural norms and the enculturation process. From a cross-cultural perspective, it examines the process by which cultural norms are transmitted and learned, as well as the effect of culture change on the individual. The

historical development of the field as well as contemporary trends are also discussed in both theoretical and applied contexts.

Nickerson

ANT 511 Anthropological Theory. Preqs.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0) F. Approaches theory from both an historical and contemporary point of view. Emphasizes the key anthropological concept of culture and its significance for understanding man and his works.

Graduate Staff

ANT 512 Applied Anthropology. Preq.: ANT 252 or CI. 3(3-0) S. Includes a review of the historical development of applied anthropology and a study of anthropology as applied in government, industry, community development, education and medicine. The processes of cultural change are analyzed in terms of the application of anthropological techniques to programs of developmental change.

Peck

ANT 591 Special Topics in Anthropology. Preq.: ANT 501 or equivalent. 3(3-0) F,S. This course is designed to provide the opportunity for students to investigate in depth some particular topic in anthropology. Course content and mode of study will vary, reflecting current student needs and interests. Topics will be determined by the faculty member(s) and student.

Graduate Staff

ARCHITECTURE

(Also see Design.)

ARC 400 Intermediate Architectural Design (Series). Preq: DF 102. May not be taken more than six times. 6(0-9) F,S. Design investigation aimed at the development of an understanding of the major issues confronting the architect and at the expanding of problem-solving abilities in architectural design. Students select from a number of vertically organized workshop studios which offer on an optional basis a wide range of program emphases.

Selected 500-Level Courses Open To Advanced Undergraduates

ARC 511 Professional Practice I. Preq.: Fourth year standing. 2(2-0) F. The evolution of architecture as a modern practical profession; obligations of the profession to society and to itself; the legal and ethical position of the architect in practice; comparative study of documents; the architect's working organization; emerging techniques of office practice.

ARC 512 Professional Practice II. Preq.: Fourth year standing. 2(2-0) S. Continuing study of standard documents and emerging techniques of practice, with emphasis on the principles and improved techniques of writing construction specifications; interrelationship of The Contract Documents; comparative study of techniques for controlling competitive bidding.

ARC 521, 522 Advanced Architectural Structures I, II. Preq.: (521) DN 352; (522) ARC 521. 3(3-0) F,S. Gravity and non-gravity loads on structures; comparative behavior of structural materials; comparative behavior of simple structural systems; approximate and exact analysis procedures as applied to systems; principles of approximate and exact design in timber, steel and reinforced concrete; architectural/structural/mechanical compatibility in systems; basic principles of foundation analyses and design.

ARC 531, 532 Advanced Building Technology I, II. Preqs.: DN 253, 254. 2(1-3) F,S. A synthesis of studies in building science undertaken in previous courses. Material assemblies in practical applications, dimensional characteristics of mechanical and construction systems for buildings, and special projects in selected areas of building science.

ARC 542 Investigations in Recent World Architecture. Preq.: CI. 3(2-1) F. A lecture seminar course intended to provide a description and analysis of recent developments in architectural design through an examination of projects by many of the world's most important architects. Primary emphasis will be placed on emerging design concepts and theories as expressed in the built architecture and the visionary proposals of the past two decades.

ARC 581, 582 Conceptual Issues in Architecture and Design. Preq.: Grad. standing or advanced undergrad. 3(3-0) F,S. Fall semester An examination and dialogue concerning current issues in American and Western society and their relation to the activities and goals

of architects and designers. Spring semester An investigation into issues and values currently held by participating students and their relation to an anticipated career in architecture and design.

AEROSPACE STUDIES (AIR FORCE ROTC)

(Also see Military Science)

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 U.S. Air Force and U.S. Strategic Offensive Forces. Introduction to U.S. Strategic Defensive Forces. The laboratory, Corps Training, provides experience in drill movement, knowledge of customs and courtesies expected of an Air Force member, knowledge of Air Force career opportunities, and the life and work of the junior officer. Staff

AS 122 The Air Force Role in the Department of Defense II. Preq: AS 121 or equivalent. 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. Staff

AS 221 The Development of Airpower I. Preq.: AS 122 or equivalent. 1(1-1) F. Airpower from the early years of powered flight through World War II. Emphasis on the development of employment concepts. Factors which have prompted research and technological change. Events which show the impact of airpower on strategic thought. Corps Training develops skills and further studies the junior officer environment. Staff

AS 222 The Development of Airpower II. Preq: AS 221 or equivalent. 1(1-1) S. Airpower from the end of World War II to the present. Emphasis on employment concepts, technological change, and the impact of airpower on strategic thought. Leadership experiences and study of junior officer environment in Corps Training. Staff

PROFESSIONAL OFFICER EDUCATION

AS 321 Air Force Management and Leadership. Preqs: Four year AFROTC Cadet: AS 222. Two year non-veteran student: 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. Staff.

AS 322 Air Force Management and Leadership II. Preq: AS 321 (or permission). 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. Staff

AS 421 American Defense Policy I. Preq: AS 322. 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. Staff

AS 422 American Defense Policy II. Preq: AS 421 (or permission) 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. Staff

AS 495 Special Topics in Aerospace Studies. Preq: CL 2(2-0) F/S. Offered as needed to treat new or special subject matter relating to the Department of the Air Force. Staff

AS 499 Flight Instruction Program Ground School. 0(3-0) S. Develops aeronautical knowledge required by the Federal Aviation Administration for private pilots. It familiarizes students with the appropriate general and visual flight rules of Part 91 of the Federal Aviation Regulations, obtaining and evaluating of flight weather reports and flight planning elements such as plotting courses, estimating time enroute and fuel requirements. Required in the Flight Instruction Program (FIP) for Air Force ROTC cadets.

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 or junior 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 field 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 201 Shop Practices. 2(1-3) F,S. Designed to give the student an understanding of materials, tool processes and safety practices related to the operation and maintenance of a mechanized farming operation as well as general shop practice related to other agricultural industries. Laboratory exercises will be used to relate theory to practice as basic shop skills are developed. Blum, Howell

BAE 211 Farm Machinery. 3(2-3) F,S. A study of the operations, servicing, and adjustment of farm machines. Functional and energy requirements, and efficient operations as well as economic considerations in ownership are stressed. Howell

BAE 251 Elements of Biological and Agricultural Engineering. Preq: Enrollment in SBE curriculum. 3(2-3) F. Pertinent topics basic to agricultural engineering and current progress relating to the different subject areas. Introduction to various engineering procedures, tool processes and materials utilized by the agricultural industries. Blum

BAE 303 Energy Conversion in Biological Systems. Preqs: BS 100, MA 112 or 201, 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 (SSC) 321 Water Management. Preq: Junior standing. 4(3-3) F. The application of water management principles is examined. Topics discussed include the hydrologic cycle, runoff, surface and subsurface drainage to include open ditch drainage and land forming, irrigation, erosion, soil conservation practices such as terracing, contouring and strip crop ping, sedimentation, farm pond construction, open channel flow, environmental laws that pertain to water management, and the basic principles of surveying. Sneed

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. Blum

BAE 341 Farm Electrification and Utilities. Coreq: PY 212 or 221. 4(3 3) S. Practical and efficient use of electricity as an energy source for agricultural and home applications. Topics include energy conservation, electric rates, farm and house wiring, circuit design, single phase and three-phase distribution systems, electric motors, lighting, heating, electric controls, safety and protective devices, and home water systems. Glover

- BAE 342 Agricultural Processing.** Preqs: MA 301, MAE 301. 4(3-2) S. Theory and application of heat and mass transfer to processing of agricultural crops. Topics include psychrometrics, thin layer and deep bed drying, continuous flow drying, and principles of biochemical processing. Problem sessions will demonstrate principles of fluid flow, materials handling, process control, and various drying systems. Young
- BAE 361 Analytical Methods.** Preq: MA 301; Coreq. MAE 314. 3(2-3) F. Develops skills in mechanical design and problem solving. Mechanical design includes graphical and analytical determinations of velocity and acceleration, analysis and synthesis of linkages, design and or selecting of beams, shafts, columns, bearings, clutches, brakes, gears, belts and chains. Approximately one fourth of the course develops skills related to converting ill-defined problem situations into tractable engineering problems. Abrams
- BAE 381 Agricultural Structures and Environment.** Preqs: MAE 314, MAE 301. 3(2-3) S. Principles of environmental control and structural analysis are combined with biological principles for the design of agricultural structures. Topics include physiological reactions of animals, plants and agricultural produce to their environment, applications of heat transfer and psychrometrics in calculating ventilation requirements and heating or cooling loads, structural analysis, material selection, agricultural waste management, and economic considerations of various structural alternatives. Baughman
- BAE 391 Electrotechnology in Biological and Agricultural Engineering.** Preq: EE 331. 3(2-3) F. Basic concepts for selecting and utilizing electromagnetic devices. Switching circuits and central circuits are discussed and transducers and measurement techniques are related to agricultural problems. McClure
- BAE 411 Farm Power and Machinery.** Preqs: BAE 211, PY 211 or 221. 3(2-3) S. The application of heat engineering principles in the development and utilization of power of internal combustion engines, both spark ignition and diesel. Thermodynamic principles and their application to the actual design and construction of engines. Principles of carburetion and ignition. Power transmission units, hydraulics and hydraulic controls. Power measurement and testing, and the economic utilization of power units. Fore
- BAE (FS) 432 Food Engineering II.** Preq: FS 331. 3(2-3) S. Alt. yrs. (See food science.)
- BAE 433 Processing Agricultural Products.** Preq: PY 212. 4(3-3) S. This course will investigate the equipment used for agricultural processing on the farm or farm-related enterprises. The principles of operation and design features of processing equipment will be covered. Major topics include: (1) feed grinding, (2) milk processing, (3) cleaning, grading, and handling agricultural commodities, (4) crop drying and storing, and (5) refrigerated storage. Willits, Young
- BAE 451, 452 Agricultural Engineering Design I and II.** Preq: Sr. standing in SBE curriculum. 3(1-6) F.S. 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 461 Analysis of Agricultural Systems.** Preqs: MA 114 or 112, EB 212. 3(2-2) F. Basic concepts of systems analysis with application to agricultural problems. Tools and methodology of systems analysis. Topics include economics of decision making, linear programming, networks and inventory. A unit on machinery management includes cost analysis, scheduling, selection and replacement. Sowell
- BAE 462 Functional Design of Field Machines.** Preqs: BAE 361 or equivalent, SSC 200. 2(2-3) S. The design and operation of the modern farm tractor and field machines that make effective use of energy and labor in farm commodities production. Topics include (a) engine cycles and efficiencies, Nebraska test procedures, power trains, traction efficiencies, rolling resistances, and hitching of tractors and (b) principles and devices used to accomplish functional objectives in tillage, planting, pesticide application and harvesting equipment. Bowen
- BAE (CHE) 465 Introduction to Biomedical Engineering.** Preqs: MA 202 or 212, PY 212 or 221. 3(3-0) F. (See chemical engineering.)
- BAE (SSC) 471 Agricultural Water Management.** Preqs: BS 100, SSC 200. 4(3-2) F. Aspects of hydrology and soil-water-plant relationships as related to agricultural water

management. Drainage and irrigation emphasized. Water quality, agricultural related pollution, and water laws discussed. Westerman

Selected 500-Level Courses Open To Advanced Undergraduates

BAE 552 Instrumentation for Agricultural Research and Processing. Preqs: EE 331, MA 301. 2(1-3) F. Theory and application of primary sensing elements and transducers. Generalized performance characteristics and the use of standards. Use of specialized measurement systems for agricultural research and processing including an introduction to correlation and power spectral density measurements. McClure

BAE (CE, MB) 570 Sanitary Microbiology. 3(2 3) S. (See civil engineering.)

BAE (CE) 578 Agricultural Waste Management. Preq: Grad. or advanced undergrad. standing. 3(2-3) F. A study of agricultural and associated processing wastes. Special laboratory techniques required for the characterization of these wastes will be emphasized. Principles and examples considered will be utilized to develop waste management and non-destructive waste utilization systems that are integral to the total operation. Humenik

BAE (FS) 585 Biorheology. Preqs: PY 205, MAE 314. 3(2 2) S. The concepts of strain, stress and the mechanical viscoelastic properties of biological solids, fluids and slurries. The time-dependent deformation and flow of bio-materials elements of strength of materials, rheological equations and model concepts, creep-relaxation and dynamic behavior, contact problems and the Boltzmann superposition principle as a function of time, temperature and moisture content. Hamann

BAE 590 Special Problems. Preq: Sr. or grad. standing in biological and agricultural engineering. Credits Arranged. F,S,Sum. Each student will select a subject on which to do research and write a technical report on the results. The individual may choose a subject pertaining to his or her particular interest in any area of study in biological and agricultural engineering. Graduate Staff

BIOCHEMISTRY

BCH 351 Elementary Biochemistry. Preq: CH 223. 3(3-0) F,S,Sum. An introduction to the basics of biochemistry, dealing with the chemistry of living organisms and the various areas of research the discipline encompasses. Armstrong, Horton, Main

BCH 352 Elementary Biochemistry Laboratory. Preq: BCH 351 (may be taken concurrently). 1-2 F,S. A laboratory experience to complement BCH 351 which will emphasize basic biochemical laboratory techniques and analysis of data. Knopp, Miller

BCH 490 Special Studies in Biochemistry. Preq: Senior standing. 1-3 F,S,Sum.

Selected 500-Level Courses Open To Advanced Undergraduates

BCH 551 General Biochemistry. Preq: Three years of CH including CH 223 or equivalent; CH 331 or 431 strongly recommended. 3(3-0) F. Principles of modern biochemistry including structural and metabolic relationships of carbohydrates, lipids, proteins, nucleic acids, enzymes and metabolic regulation. Jones

BCH 552 Experimental Biochemistry. Preq: CH 223; CH 315 recommended; Preq. or Coreq: BCH 551, 3(1-6) F. An introduction to fundamental techniques of biochemistry and molecular biology involving experimental study of carbohydrates, proteins, enzymes, nucleic acids, lipids, and metabolism. Theil

BCH (PHY) 553 Physiological Biochemistry. Preq: BCH 551. 3(3-0) S. Application of biochemical methods to the elucidation of the function of whole organisms. A. Biochemistry of 1) blood, 2) water, electrolyte, acid-base balance, 3) renal function, 4) muscle metabolism, 5) central nervous system, 6) autonomic nervous system, and 7) endocrine system. B. Biochemistry of adaptation to environment 1) high and low P_{O_2} , 2) hot and cold, 3) wet and dry, 4) pollution. Longmuir

BCH 554 Radioisotope Techniques in Biology. Preq: BCH 351 or CI. 2(1-3) S,Sum. Theory and application of radioisotope techniques used in biology. The different modes of

radioactivity are correlated with methods of measurement. Emphasis on use and limitations of various instruments and techniques and on their application to research problems. Sister

BCH 557 Introductory Enzyme Kinetics. Preqs: BCH 551 and MA 201 or MA 212. 3(3-0) F. Basic principles of chemical kinetics are applied to develop enzyme kinetics. Limitations of the Michaelis equation are considered in light of the general rate equation. Transient state kinetics are then considered. Inhibition and activation, pH functions, effects of temperature, and elucidation of mechanisms follow. The kinetics of allosteric site interactions and of conformational forms complete the course. Main

BCH (GN, MB) 561 Biochemical and Microbial Genetics. Preqs: BCH 351 or 551, GN 411 or 505, MB 401 or equivalent. 3(3-0) S. A study of development of the fields of biochemical genetics and microbial genetics, emphasizing both techniques and concepts currently used in research in these areas. Includes lectures and discussions of current research publications. Armstrong

BCH 590 Special Topics in Biochemistry. Preq: BCH 351 or equivalent. Credits Arranged, Maximum 3. F,S,Sum. The study of topics of special interest by small groups of students instructed by members of the faculty. Graduate Staff

BIOMATHEMATICS

BMA 493 Special Topics in Biomathematics. Preq: Cl. 1-3 F,S. Directed readings, problem sets, written and oral reports at an introductory level to meet student need and interest; 400-level courses during the developmental phase. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

BMA (MA, ST) 571 Biomathematics I. Preq: Advanced calculus, reasonable background in biology or Cl. 3(3-0) F. The role of theory construction and model building in the development of experimental science. Induction vs. deduction. The historical development of mathematical theories and models for the growth of one-species populations (logistic and off-shoots), including consideration of age distributions (matrix theory, Leslie and Lopez; continuous theory, Lotka). Some of the more elementary theories on the growth of organisms (von Bertalanffy, with applications to ecology; allometric theories, cultures grown in a chemostat). Mathematical theories of two and more species systems (predator-prey, competition, symbiosis; according to the Volterra-Lotka schemes, including present-day research), and discussion of some related models for chemical reaction kinetics. Much emphasis is placed on scrutiny of the biological concepts as well as of the mathematical structure of the models in order to uncover both weak and strong points of the models discussed. Mathematical treatment of the differential equations in these models stresses qualitative and geometric aspects. van der Vaart

BMA (MA, ST) 572 Biomathematics II. Preq: BMA 571, elementary probability theory. 3(3-0) S. Continuation of topics of BMA 571. Some more advanced mathematical techniques concerning nonlinear differential equations of the types encountered in BMA 571: several concepts of stability, asymptotic directions, periodic models. Comparison of deterministic and stochastic models for several biological problems including birth and death processes. Certain aspects of linear system theory (time-invariant and variable models) used for the analysis of biological systems. Discussion of various applications of mathematics to biology, e.g., theories of aging, some recent research. van der Vaart

BMA 591 Special Topics. Preq: Cl. Maximum 3. F,S. Directed readings, problem sets, written and oral reports as dictated by need and interest of student; new 500-level courses during the developmental phase. Graduate Staff

BOTANY

BO 200 Plant Life. 4(3-3) F,S,Sum. A survey of the types of plants and their diversities in structure, life cycle, habitat, and economic importance. Troyer, Van Dyke, Witherspoon

BO 320 Local Flora. Course may be taken three times for credit. 2(0-4) F,S,Sum. A field study for non-majors of the vascular plants of the area with emphasis on identification,

ecology, and natural history. May be taken during the spring and fall, spring and summer or summer and fall, or all three semesters, for a maximum of 6 hours credit. Hardin, Stucky

BO (ZO) 360 Introduction to Ecology. Preq: A 200 level biology course. 4(3-3) F,S,Sum. The relationships between organisms and their environment, and of the interactions among organisms. An overview of basic ecology principles and their importance to man and his environment. Staff

BO 400 Plant Diversity. Preq: BO 200. 4(3-3) F. A comprehensive survey of the evolutionary diversity and phylogeny of the plant kingdom. Emphasis on the evolutionary trends and the basis for assumed relationships, considering fossils as well as living forms. Hardin

BO 403 Systematic Botany. Preq: BS 100 or 105 or BO 200. 4(2-4) S. A systematic survey of vascular plants, emphasizing terminology, family characteristics, field identification, general evolutionary relationships, and mechanisms of plant speciation. Hardin, Stucky

BO 413 Introductory Plant Anatomy. Preq: BO 200 or equivalent. 3(2-3) S. A study of the cells, tissues and organs of crop, horticultural and weed plants. The patterns of growth and differentiation of representative species will be examined. Laboratory work will emphasize microscopic examination of living material. 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 or BS 105 or BO 200, one year of college chemistry. 4(3-3) F,S. Physiology of the green plant emphasizing plant organization, water and solute relationships, organic and inorganic nutrition, growth and development. Noggle, Troyer

BO 480 Air Pollution Biology. Preq: An introductory biological course and chemistry, jr. standing. 3(2-3) S. The effects of air pollutants on biological systems at the subcellular, cellular, tissue, organ, individual and community level. Anderson, Rogers

BO 499 Independent Study in Botany. Preqs: At least eight hours of botany, advanced standing, and presentation of plan of work approved by a faculty member. 1-3 F,S. Discussions, library research, field or laboratory investigations of topics under faculty direction on a tutorial basis. May be repeated for a maximum of six credits. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

BO 510 Plant Anatomy. Preq: BO 200. 4(2-6) F. A study of the cells, tissues and organs of common flowering plants and gymnosperms. Anderson

BO 522 Advanced Morphology and Phylogeny of Seed Plants. Preq: BO 403. 4(3 3) S. A comprehensive survey of the morphology and evolution of angiosperms and gymnosperms. Special emphasis is given to vegetative and reproductive morphology of fossil and living forms, and to their presumed evolutionary relationships. (Offered 1978-79 and alt. years.) Hardin

BO 524 Grasses, Sedges, and Rushes. Preq: BO 403. 4(2-6) F. A course dealing with three large, economically and ecologically important plant families. A working familiarity will be achieved through an introduction to the special terminology used in dealing with these plants, extensive field work emphasizing keying out plants collected and a study of the recently developed modern classification of the grasses. (Offered 1979-80 and alt. years.) Stucky

BO 544 Plant Geography. Preqs: BO 403, BO (ZO) 360, GN 411 or equivalents. 3(3-0) S. A course in descriptive and interpretive plant geography, synthesizing data from the fields of ecology, genetics, geography, paleobotany and taxonomy. Includes a survey of the present distribution of major vegetation types throughout the world, a discussion of the history and development of this present pattern of vegetation and a discussion of the principles and theories of plant geography. (Offered in 1979-80 and alt. years.) Graduate Staff

BO 551 Advanced Plant Physiology I. Preqs: General botany or biology, and biochemistry. 3(3-0) F. The first half of a two-semester sequence covering the field of plant physiology. Topics will include plant organization, metabolism, water relations, solute relations, and respiration. Noggle, Troyer

BO 552 Advanced Plant Physiology II. Preqs: General botany or biology, and biochemistry. 3(3 0) S. The second half of a two-semester sequence covering the field of plant physiology. Topics will include photobiology, photosynthesis, inorganic nutrition, plant growth substances, physiology of seeds, and the physiology of vegetative and reproductive growth and development. Wynn

BO 553 Laboratory in Advanced Plant Physiology I. Preq. or coreq: BO 551. 1(0-3) F. Laboratory to accompany BO 551 Advanced Plant Physiology I. Graduate Staff

BO 554 Laboratory in Advanced Plant Physiology II. Preq. or coreq: BO 552. 1(0-3) S. Laboratory to accompany BO 552 Advanced Plant Physiology II. Graduate Staff

BO (ZO) 560 Principles of Ecology. Preq: Three semesters of college level biology courses. 4(3-3) F. A consideration of the principles of ecology at the graduate level. Each of the major subject areas of ecology is developed in sufficient depth to provide a factual and philosophical framework for the understanding of ecology. Blum

BO 561 Physiological Ecology. Preqs: BO 421 and BO (ZO) 560 or equivalent. 4(3 3) S. The plant community is approached from a physiological standpoint. Emphasis will be placed on the individual in the community and how it responds to its immediate environment on a short- and long-term basis. (Offered 1978 79 and alt. years.) Blum

BO 565 Plant Community Ecology. Preq: BO (ZO) 560 or BO (ZO) 360 or equivalent. 4(3-3) F. Consideration of the structure and function of terrestrial vascular plant communities, with emphasis on classical and recent research. Topics include measurement and description of community properties, classification, ordination, vegetation pattern in relation to environment, ecological succession, and a survey of the vegetation of North America. Wentworth

BO 570 Quantitative Ecology. Preqs: BO (ZO) 560 and ST 512 or equivalent. 3(3-0) F. A course emphasizing the quantitative techniques and theories of vegetation analysis. Topics include sampling methodologies, the evaluation of sample adequacy, spatial patterns and species associations, the measurement and interpretation of ecological diversity, gradient analysis and classification of communities, and plant population dynamics. Each of these topics will be considered from a theoretical and a practical basis. This involves local field trips, sampling, data analysis, computer programming, and interpretation in light of contemporary ecological theories. Reynolds

BO (MB) 574 Phycology. Preq: BS 100 or BO 200. 3(1 4) S. An introduction to the structure, reproduction and importance of organisms which may be included in the algae. Emphasis is on the local freshwater flora and the ecology of important species. Witherspoon

BO (MB, PP) 575 The Fungi. Preq: BO 200 or equivalent. 3(3 0) F. An overview of the fungi within the framework of a survey of the major classes. Van Dyke

BO (MP, PP) 576 The Fungi Lab. Coreq: BO 575. 1(0-3) F. Illustrative material of the fungal assemblages discussed in BO 575. Van Dyke

BO 590 Topical Problems. Preq: CI. 1-3 F,S. Discussions and readings on problems of current interest in the fields of ecology, anatomy and morphology, taxonomy, plant physiology, and cell biology. May be repeated with a change in topic for a maximum of six credits. Graduate Staff

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 including the structure and function of cells and organisms, the organization and requirements of living systems, development, heredity and evolution. Barthalmus, Beckmann, Lytle, Meyer

BS 105 Biology in the Modern World. Students may not receive credit for both BS 100 and BS 105. 4(3-3) F,S. For students who are not science majors. Treats the broad themes or principles of biology, such as metabolism, homeostasis, and interrelationships of organisms, at all levels of biological organization (i.e., molecular to biome). Emphasis on the organismic

level with man as the representative organism; his physiology, behavior, genetics and ecology are treated in depth. Meyer, Wynn

BS (ENT) 401 Bibliographic Research in Biology. Preq: Advanced undergraduate or graduate standing. 2(2-0) F. 1978 & alt yrs. (See Entomology.)

BS 495 Special Topics in Biology. 1-6 F,S,Sum. Independent research projects supervised by faculty member. Projects selected with faculty assistance and with approval of the coordinator of the Biological Sciences interdepartmental program.

Selected 500-Level Courses Open To Advanced Undergraduates

BS 590 Special Problems in Biological Instrumentation. Preq: CL 1-3 F,S. Basic components of spectrophotometers including light sources, dispersing devices, detectors and read-out methods; theoretical and practical aspects of electron microscopy; basics of analog and digital computing methods and applications of computers to biological research; methods of separation and identification of bio-polymers; principles of measurement; the application of electronics in biological measuring and sensing devices; and human cytological techniques. Course consists of five-week modules (sections) devoted to specific types of instrumentation. Graduate Staff

CIVIL ENGINEERING

CE 201 Elements of Plane Surveying. Preq: Soph. standing. 3(2-3) F. Not for CE department majors. Theory and practice of plane surveying precision specifications, horizontal and vertical control, stadia surveys, area determinations, circular and compound curves, topographic mapping, solar and celestial observations, rural and urban land surveys. Staff

CE 202 Introduction to Civil Engineering. Preq: MA 201. 2(1-3) F,S,Sum. Computer solution of typical problems in each subject area of civil engineering. Ely, Smith

CE 211 Introduction to Applied Mechanics. Coreqs: MA 212, PY 212. 3(3-0) F. The concepts of particle and rigid body mechanics. The fundamentals of equilibrium, kinematics and kinetics are applied to engineering problems involving structures and machines. CE Staff

CE 212 Mechanics of Engineering Materials. Preq: CE 211. 3(3-0) S. An introduction to the mechanics of solids. Analysis of the stresses, strains, and deformations occurring in loaded structural and machine members (including buckling loads). CE Staff

CE 213 Introduction to Mechanics. Coreq: MA 202. 3(3-0) F,S,Sum. Principles and concepts which form the basis for students in dynamics, solid and fluid mechanics. The nature and properties of force systems and stress fields. The motion of particles and description of deformation of continuous media. The role of Newton's laws, the concepts of continuity and equilibrium, and the conservational principles in problems in mechanics. CE Staff

CE 301 Engineering Surveying. Preq: Junior standing. 3(2-3) F,S. Principles of surveying and applications in planning, design and construction; including horizontal and vertical control; topographic maps, photogrammetry and elements of geodesy. Babeock, Barnes

CE 305 Transportation Engineering I. Preq: CE 301. 4(3-2) F,S. Integrated approach to planning, designing operation of transportation systems. Engineering and economic aspects of basic transport modes, (including highway, rail, water and air facilities) are studied. Cribbins, Heimbach, Horn

CE (ESM) 308 Solid Mechanics II. Preq: MAE 314 or CE 313. 3(3-0) Equations for thin plates. Introduction to the theory of plasticity and experimental methods in solid mechanics. Plastic stress-strain relationships and two-dimensional problems in plastic behavior, and fracture. CE Staff

CE (ESM) 311 Experimental Engineering Science I. Coreqs: MAE 308, 208, 314. 3(1-6) F. The experimental analysis concept starting with the question of how observations and measurements are made. Illustrations of experimental methods which enable the inference of one physical variable by the observation of another but related one. Bingham

CE (ESM) 312 Experimental Engineering Science II. Preq: CE (ESM) 311. 3(1-6). The CE (ESM) 311 background is utilized in broader problems which require the synthesis from

- several experimental methods as well as mathematical and/or numerical methods of an analytical system.
Bingham
- CE 313 Mechanics of Solids.** Preq: CE 213. 3(3-0) F,S,Sum. For CE students. Development of the equations which describe the linear elastic solid. Approximate solutions and comparison with the theory of elasticity to problems involving axial, torsional and flexural loading.
CE Staff
- CE 325 Structural Analysis.** Preq: CE 313. 3(2-2) F,S,Sum. Stress analysis of statically determinate beams and framed structures under fixed and moving loads; analysis of displacements by methods of conjugate beam and virtual work; indeterminate structural analysis of both rigid frames and trusses by virtual work and by stiffness method.
Havner, Tung
- CE 326 Structural Engineering I.** Preq: CE 325 4(3-2) F,S,Sum. Fundamental principles of elastic, inelastic and ultimate strength analysis and proportioning of structural members in metal, concrete and timber.
Hulsey, Mirza
- CE 332 Materials of Construction.** Preq: MAT 200. 3(2-3) F,S,Sum. Manufacture and properties of mineral and bituminous cements and mineral aggregates. Mechanical properties of portland cement concrete, bituminous concrete, masonry units materials and timber products. Materials testing for research.
Barnes, Mullen
- CE 342 Soil Engineering I.** Preq: CE 332; Coreq: CE 313. 4(3-2) F,S. Soil identification, index properties, effective stress concepts, settlement analysis, evaluation of shear strength and bearing capacity, fundamentals of foundation selection and design.
Kashef, Richardson, Wahls
- CE 365 Construction Engineering I.** Preq: Jr. standing. 4(3-2) F,S. Construction operations course emphasizing organization of construction industry; construction methods, equipment, productivity and safety; project planning; scheduling and control.
Blessis, Johnston, Nunnally
- CE 370 Elements of Environmental Hygiene.** Preq: Soph. standing. 3(2-3) S. Environmental factors affecting human health and their evaluation and control. Topics include: water supplies; sewage disposal; swimming pool and refuse sanitation; insect and rodent control; milk and food sanitation; the physical factors of noise, heat, illumination and ionizing radiation; housing; industrial hygiene; and environmental hygiene programs.
Staff
- CE 382 Hydraulics.** Preq: CE 213. 4(3-3) F,S. Properties of fluid, laws of conservation of mass, momentum and energy; applications to the mechanics of flow through pipes and channels; fluid measurements; theory of design and characteristics of hydraulic machines.
Amein, McDonald
- CE 383 Water Resources Engineering I.** Preq: CE 382. 4(3-2) F,S. The study of engineering hydrology and the elements of urban water systems. Commonly encountered applications in the management of urban water quantity and quality are illustrated with case studies in flood control, stormwater collection, water supply and water and waste treatment.
Amein, Malcom
- CE 406 Transportation Engineering II.** Preq: CE 305. 3(2-2) F,S. Urban transportation problems and design of modal interfaces such as airports, shopping centers, parking garages, port facilities and other multimodal terminals.
Babcock, Horn
- CE (ESM) 411,412 Engineering Cybernetics I, II.** Preq: Senior standing in ESM or equivalent background. 3(1 4) F,S. A year course of formal lectures on topics which include dynamics of linear and nonlinear systems; hereditary and feedback couplings; continuous, discrete, random and stochastic inputs; system stability; reliability; optimization; and the ultra-stable autonomous system. Student participation, in either individual or collective form, in extra class work of personal character in the design of particular engineering systems.
McDonald
- CE (ESM) 415 Engineering Science in Contemporary Design.** Preq: Senior standing in ESM. 2(1 3) S. Draws upon student's background in engineering science to analyze current problems. Case histories and evaluation of selected designs.
Bingham, Douglas

- CE 425 Intermediate Structural Analysis.** Preq: CE 325. 3(3-0) F,S. Rigorous treatment, at intermediate level, of indeterminate structural analysis. Energy principles, force and displacement methods, special topics. Havner, Mirza
- CE 427 Structural Engineering II.** Preq: CE 326. 3(2-2) F,S. Basic concepts of structural design. Analysis and design of complete structural systems. Hulsey, Uyanik
- CE 428 Structural Design in Wood.** Preq: CE 326. 3(2-2) F. Structural behavior of wood under loads; design of structural elements in wood; strength properties of wood fasteners; design projects with clear wood, plywood and glued laminated wood. Uyanik
- CE 443 Soil Engineering II.** Preq: CE 342. 3(3-0) F,S. Lateral earth pressure theories and their application to analysis and design of slopes and retaining structures; ground water hydraulics; placement of fills; soil behavior in pavement systems, stabilization techniques. Kashef, Wahls
- CE 450 Civil Engineering Design.** Preq: One from: CE 406, 427, 443, or 484. 3(1 6) F,S. Integrated team approach to a major civil engineering project involving planning, design and analysis under realistic conditions including environmental factors. Babcock
- CE 460 Construction Engineering Project.** Preqs: CE 463, 466. 3(1-6) F,S. Planning, design, construction and management of a construction project. Blessis
- CE 463 Cost Analysis and Control.** Preq: CE 365. 3(2-3) F,S. Cost engineering, project estimating, bid procedures, construction cost analysis and control. Blessis, Johnston, Nunnally
- CE 464 Legal Aspects of Contracting.** Preq: Sr. standing. 3(3 0) S. Legal aspects of construction contract documents and specifications; owner-engineer contractor relationships and responsibilities; bids and contract performance; labor laws. Blessis
- CE 466 Construction Engineering II.** Preqs: CE 326, 365. 3(2-3) F,S. Introduction to building systems construction emphasizing planning, analysis, design and construction of structural subsystems. DeBruhl
- CE 472 Elements of Air Quality Management.** Preq: College level physics and sr. standing. 3(2-3) S. Pollution and community air quality management, including pollutant sources; effects on biological systems, materials, and the atmosphere; meteorological factors; air sampling; abatement and control techniques; air quality and emission standards; and legal, economic and administrative aspects. Hauser
- CE 484 Water Resources Engineering II.** Preq: CE 383. 3(3 0) F,S. The elements of the design of water supply and wastewater disposal systems. Chao, Smallwood
- CE 486 Sanitary Engineering Measurements of Water Quality.** Preqs: Freshman chemistry and sr. standing in Engineering or Agriculture and Life Sciences. 3(2-3) S. Introduction to elementary measurement and interpretations of pollutants in water and wastewater. Examination of the nature and character of municipal refuse. Chao
- CE (ESM) 495 Special Studies in Mechanics.** 1-3. Offered as needed to treat new or special subject matter. CE Staff
- CE 498 Special Problems in Civil Engineering.** Preq: Sr. standing in CE or CEC. 1 3 F,S. Directed reading in the literature of civil engineering, introduction to research methodology, seminar discussions, dealing with special civil engineering topics of current interest. Staff
- Selected 500-Level Courses Open To Advanced Undergraduates*
- CE 501 Transportation Systems Analysis.** Preq: CE 406. 3(3-0) F. Application of systems analysis to multi modal transportation studies. Covers the analysis, planning, and design of transport facilities for both the public and private sectors. Planning is discussed from the short-run as well as the long-run perspective. Heimbach
- CE 502 Transportation Operations.** Preq: CE 406. 3(3-0) F. The analysis of traffic and transportation engineering operations. Horn
- CE 503 Transportation Design.** Preq: CE 406. 3(2-3) S. The geometric elements of traffic and transportation engineering design. Babcock, Horn

CE 504 Water Transportation. Preq: CE 305. 3(3-0) F. The planning, design, construction and operation of waterways, ports, harbors and related facilities. Development of analytical techniques for evaluating the feasibility of piers, ports and multipurpose river basin projects. The design of marine structures and civil works that are significant in civil engineering, including locks, dams, harbors, ports, and contractive and protective works.

Cribbins

CE 505 Mass Transportation. Preq: CE 406. 3(3-0) S. Definition of the characteristics, trends, issues, and technologies related to mass transportation, and the identification of methodologies applicable to the planning, design and management of mass transportation systems. This includes applications to the urban, inter-urban and rural settings for both short and long-range planning horizons.

Graduate Staff

CE 506 Municipal Engineering Projects. Preq: Sr. standing in CE or CEC. 3(2-3). Special problems relating to public works, public utilities, urban planning and city engineering.

Babcock, Smallwood

CE 507 Airphoto Analysis I. Preq: Sr. Standing. 3(2-3) Sum. Principles and concepts for engineering evaluation of aerial photographs, including analysis of soils and surface drain age characteristics.

Wahls

CE 511, 512 Continuum Mechanics I, II. Preqs: CE 313 or MAE 314, CE 382 or MAE 308, MAE 301, MA 405. 3(3-0) F,S. The concepts of stress and strain are presented in generalized tensor form. Emphasis is placed on the discussion and relative comparisons of the analytical models for elastic, plastic, fluid, viscoelastic, granular and porous media. The underlying thermodynamic principles are presented, the associated boundary value problems are formulated and selected examples are used to illustrate the theory.

McDonald

CE 513 Theory of Elasticity I. Preq: CE 313 or MAE 314. 3(3 0) F. The fundamental equations governing the behavior of an elastic solid are developed in various curvilinear coordinate systems. Plane problems, as well as the St. Venant problem of bending, torsion and extension of bars are covered. Displacement fields, stress fields, Airy and complex stress functions are among the methods used to obtain solutions.

Douglas, Gurley

CE 521 Advanced Strength of Materials. Preq: CE 313 or MAE 314. 3(3-0) F. Stresses and strains at a point: rosette analysis; strength theories, stress concentration and fatigue; torsion and unsymmetrical bending of open and closed sections; inelastic, composite and curved beams; energy methods; shear deflections; and membrane stresses in shells.

Graduate Staff

CE 522 Elastic Stability. Preqs: CE 521, MA 301, 405. 3(3-0) S. A study of elastic and plastic stability. The stability criterion as a determinant. The energy method and the theorem of stationary potential energy. The solution of buckling problems by finite differences and the calculus of variations. The application of successive approximations to stability problems.

Graduate Staff

CE 523 Theory of Plates and Shells. Preqs: CE 313 or MAE 314, MA 511. 3(3-0) F. Bending theory of thin plates; geometry of surfaces and stresses in shells. Various methods of analysis are discussed and illustrated by problems of practical interest.

Graduate Staff

CE 524 Analysis and Design of Masonry Structures. Coreq: CE 427. 3(3-0). Theory and design of masonry arches, culverts, dams, foundations and masonry walls subjected to lateral loads.

Graduate Staff

CE 525, 526 Matrix Structural Analysis I, II. Preq: (525): CE 425; (526): CE 326. 3(3-0) F,S. Matrix methods of structural analysis for digital computer solutions for general plane frames, trusses, and grids as well as general three-dimensional trusses and frames. Inclusion of effects due to prestrain, temperature, elastic stability functions, joint deformations, and support settlements. Introduction to finite element analysis of plane elasticity problems.

Hulsey, Smith

CE 531 Structural Models. Preq: CE 427. 3(2 3) F. Dimensional analysis and structural similitude, indirect and direct models, model materials and experimental techniques, individual project in structural model analysis.

Hulsey, Matzen, Zia

CE 534 Plastic Analysis and Design. Preq: CE 427. 3(3-0) S. Theory of plastic behavior of

steel structures; concept of design for ultimate load and the use of load factors. Analysis and design of components of steel frames including bracings and connections. Smith

CE 536 Theory and Design of Prestressed Concrete. Coreq: CE 427. 3(3-0) F. The principles and concepts of design in prestressed concrete including elastic and ultimate strength analyses for flexure, shear, torsion, bond and deflection. Principles of concordancy and linear transformation for indeterminate prestressed structures. Application of prestressing to tanks and shells. Mirza, Zia

CE (MSE) 541 Gravity Wave Theory I. 3(3-0) S. (See marine science and engineering.)

CE 543 Hydraulics of Ground Water. Preq: CE 382 or 342 or equivalent. 3(3-0) F. Principles of ground water hydraulics; theory of flow through idealized porous media; the flow net solution; seepage and well problems. Kashef

CE 544 Foundation Engineering. Preq: CE 342. 3(3-0) S. Subsoil investigations; excavations; design of sheeting and bracing systems; control of water; footing, grillage and pile foundations; caisson and cofferdam methods of construction. Graduate Staff

CE 548 Engineering Properties of Soils I. Preq: CE 342. 3(2-3) F. The study of soil properties that are significant in earthwork engineering, including properties of soil solids, basic physiochemical concepts, classification, identification, plasticity; permeability, capillarity and stabilization. Laboratory work includes classification, permeability and compaction tests. Kashef, Richardson

CE 549 Engineering Properties of Soils II. Preq: CE 548. 3(2-3) S. Continuation of CE 548, including the study of compressibility, stress-strain relations and shear strength theories for soil. Laboratory work includes consolidation and shear strength tests. Langfelder, Richardson

CE 551 Theory of Concrete Mixtures. Preq: CE 332. 3(3-0) F. A study in depth of the theory of portland cement concrete mixtures including types and properties of portland special cements; chemical reactions; brief examination of history of mixture design; detailed study of current design methods; properties of fresh and hardened concretes; strength-ageing relationships; durability; admixtures; special concretes; production and quality control. Mullen

CE 553 Asphalt and Bituminous Materials. Preq: CE 332. 3(2-3) F. A study in depth of properties of asphalts and tars for use in waterproofing and bituminous materials, and theories of design of bituminous mixtures for construction and paving uses including types and properties of asphalt cements, cutbacks, emulsions, blown asphalts and tars; brief examination of historical developments; detailed study of properties and design of bituminous mixtures; and current research. Laboratory work includes standard tests on asphalts, tars, and road oils; design, manufacture and testing of trial batches; and current research techniques. Barnes, Mullen

CE 555 Highway and Airport Pavement Design. Preq: CE 406 or 443. 3(2-3) S. Theoretical analysis and design of highway and airport pavements with critical evaluation of current design practices. Barnes

CE (BAE, MB) 570 Sanitary Microbiology. Preq: MB 401 or equivalent. 3(2-3) S. Fundamental aspects of microbiology and biochemistry are presented and related to problems of stream pollution, refuse disposal and biological treatment. Laboratory exercises present basic microbiological techniques and illustrate from a chemical viewpoint some of the basic microbial aspects of waste disposal. Chao

CE 572 Design of Water and Wastewater Facilities. Preq: CE 571. 3(3-0) S. Theory and design of water and wastewater treatment plants. Smallwood

CE 573 Unit Operations and Processes in Waste Treatment. Preq: CE 486; Coreq: CE 571. 3(1-6) F. Unit operations and processes in water and wastes engineering, including sedimentation, thickening, chemical coagulation, vacuum filtration, carbon adsorption, biological treatment, and special projects. Chao, Galler

CE (NE) 574 Environmental Consequences of Nuclear Power. Preq: CL 3(3-0) S. An examination of the environmental consequences resulting from the siting, construction and

operation of nuclear power plants as well as the environmental consequences of alternatives to nuclear power. Fuel sources; fuel reprocessing; sources and treatment of solid, liquid, gaseous wastes; the costs of minimizing wastes and the effects of rejected heat; beneficial uses of rejected heat; pertinent federal and state regulations are examined. Smallwood

CE 575 Civil Engineering Systems. Preq: MA 405. 3(3-0) S. An examination of civil engineering systems and their design optimization. The systems to be studied include water resources engineering, structural engineering, transportation engineering and construction. Galler

CE 576 Atmospheric Pollution Preq: Grad. or advanced undergrad. standing. 3(3-0) F. A survey of the problem of atmospheric pollution. Topics to be discussed include: pollutant sources; effects on man and other animals, vegetation, materials and visibility; meteorological factors, air sampling; control devices; air quality and emission standards; and legal, economic and administrative aspects. Hauser

CE (BAE) 578 Agricultural Waste Management. 3(2-3) F. (See biological and agricultural engineering.)

CE 580 Flow in Open Channels. Preq: CE 382. 3(3-0) F,S. The theory and applications of flow in open channels, including dimensional analysis, momentum-energy principle, gradually varied flow, high velocity flow, energy dissipators, spillways, waves, channel transitions and model studies. Amein

CE (MSE) 581 Introduction to Oceanographic Engineering. Preq: CE 382. 3(3-0) F. A rigorous treatment of the engineering aspects of physical oceanography. The theory for the propagation of waves, methods of wave forecasting and the analysis of wave spectra are presented. The applications of physical oceanography to the design of marine and coastal installations are shown. Amein

CE 591, 592 Civil Engineering Seminar. 1(1-0) F,S. Discussions and reports of subjects in civil engineering and allied fields. Graduate Staff

CE 598 Civil Engineering Projects. 1-6 F,S. Special projects in some phase of civil engineering. Graduate Staff

CHEMISTRY

CH 101 General Chemistry I. Preq: None; MA 111 or equivalent strongly recommended. 4(3-3) F,S,Sum. Fundamental chemical concepts of composition and stoichiometry; atomic structure; bonding and molecular structure, including stereochemistry; chemical reactions; states of matter, including solutions. Should be followed by CH 103, 105, or 107.

CH 103 General Chemistry II. Preq: CH 101. 4(3-3) F,S,Sum. Designed as a terminal course and for students in curricula which do not require full-year chemistry courses beyond the freshman level. Topics include acid-base reactions, homogeneous and heterogeneous equilibria, electrochemistry, and descriptive aspects of inorganic, organic, nuclear and biochemistry.

CH 104 Experimental Chemistry. Coreq: CH 105. 1(0-3) F,S,Sum. Laboratory supplement to CH 105. Required for CH 105 students who plan to take additional chemistry courses.

CH 105 Chemistry Principles and Applications. Preq: CH 101. 3(3-0) F,S,Sum. A continuation of CH 101, intended primarily for engineering students. Emphasis on introductory chemical thermodynamics, equilibrium, electrochemistry, chemical kinetics, and the application of basic chemical principles to the treatment of organic and inorganic systems. CH 105 serves as prerequisite for additional chemistry courses only if supplemented by CH 104.

CH 106 Laboratory Techniques I. Coreq: CH 101M. 1(0-3) F. For students majoring in chemistry to supplement CH 101 laboratory.

CH 107 Principles of Chemistry. Preq: CH 101 with a grade of C or better. 4(3-3) F,S,Sum. Continuation of CH 101 for students who plan to take a full-year course in advanced chemistry and for those desiring a more quantitative course than CH 103. Emphasizes detailed quantitative aspects of stoichiometry, kinetics, equilibrium and electrochemistry, and the treatment of chemical reactions in terms of acid-base concepts.

- CH 108 Laboratory Techniques II.** Coreq: CH 107M. 1(0-3) S. For students majoring in chemistry to supplement CH 107 laboratory.
- CH 111 Foundations of Chemistry.** 4(3-2) F,S,Sum. Designed to acquaint the non-science majors with the basic subject matter of chemistry and to indicate how this knowledge relates to their professions. Selected chemical concepts are developed in depth with both fundamental principles and practical consequences given nearly equal weight.
- CH 220 Introductory Organic Chemistry.** Preqs: CH 103 or 107, or CH 104 and 105. 4(3-3) F,S,Sum. Topics include alkanes and cycloalkanes, reactions of carbon-carbon multiple bonds, elimination and substitution reactions of alcohols and alkyl halides, aromatic compounds, carbonyl compounds, organic acids and derivatives, and organic bases.
- CH 221, 223 Organic Chemistry I, II.** Preq: (221) CH 107; (223) CH 221. 4(3 3) F,S,Sum. CH 221 and CH 223 cover the fundamentals of organic chemistry, including both aliphatic and aromatic compounds. CH 221 deals mostly with structure, stereochemistry, reactions, and mechanisms associated with a study of the hydrocarbons.
- CH 315 Quantitative Analysis.** Preqs: CH 103 or 107, or CH 104 and 105. [Credit not allowed for both CH 315 and 317.] 4(3-3) F,S,Sum. Fundamental principles and modern techniques of chemical analyses. Topics include spectrochemical, electrochemical, and volumetric methods of analysis, modern chemical instrumentation, and interpretation of data.
- CH 317 Quantitative Analysis for Life Science Students.** Preqs: CH 103 or CH 107 or CH 104 and 105. (Credit not allowed for both CH 315 and CH 317.) 4(3-3) S. An introduction to modern methods of qualitative and quantitative chemical analysis. Emphasis will be placed on clinical and biochemical techniques.
- CH 331 Introductory Physical Chemistry.** Preqs: CH 103 or 107, or CH 104 and 105; MA 102 or 112. 4(3-3) F,S. For students whose mathematics background is not sufficient to meet CH 431, 433 requirements, but who desire instruction on chemical principles above freshman level.
- CH 401 Systematic Inorganic Chemistry.** Coreq: CH 431 or CH 331. 3(3 0) S. Studies of theoretical principles and discussions of experimental synthetic, purification, and identification procedures pertaining to inorganic substances. The physical and chemical behavior of inorganic compounds is also discussed.
- CH 411 Analytical Chemistry I.** Preq: CH 434. 4(2-6) F. Includes the design, execution, and interpretation of quantitative chemical measurements. Chromatographic, precipitation and spectroscopic methods.
- CH 413 Analytical Chemistry II.** Preq: CH 411. 4(2-6) S. Methods of quantitative analysis based on solution chemistry, electrochemistry and reaction kinetics.
- 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 202, PY 203 or 208; Coreq: MA 301. 3(2-1) F,S,Sum. CH 431 and CH 433 provide an intensive study of physical chemical principles including states of matter, classical and statistical thermodynamics, physical and chemical equilibrium, properties of solids and solutions, electrochemistry, reaction kinetics, kinetic theory, and transport properties. Arrangement of topics between courses may vary from year to year.
- CH 433 Physical Chemistry II.** Preqs: CH 431, MA 301. 3(2 1). F,S,Sum. (See description under CH 431.)
- CH 434 Physical Chemistry II Laboratory.** Coreq: CH 433. 2(0 6) S. A project oriented course to acquaint chemistry students with modern physical chemistry techniques.
- CH 435 Physical Chemistry III.** Preqs: CH 431, MA 301. 3(3-0) F. A continuation of CH 431, emphasizing quantum mechanics, molecular structure and chemical bonding.

CH (TC) 461 Introduction to Fiber-Forming Polymers. Preq: CH 223. 3(3-0) F. (See textile chemistry.)

CH 490 Chemical Preparations. Preq: Three years of CH. 3(0-9) F,S,Sum. Library and laboratory work in preparative chemistry. Synthetic procedures will be selected to illustrate advanced methods and techniques in both inorganic and organic chemistry.

CH 491 Honors Chemistry. Preq: Admission to honors program or consent of department. 1-3 F,S. A special studies course for superior students pursuing chemistry studies in greater depth.

CH 493 Chemical Literature. Preq: Three years of CH. 1(1-0) F. A systematic introduction to the location and retrieval of information required for the solution of chemical problems.

CH 495 Special Topics in Chemistry. Preq: Cl. 1-3 F,S. To serve needs not covered by existing courses.

CH 499 Senior Research in Chemistry. Preq: Three years CH. 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 Inorganic Chemistry I. Preq: CH 433. 3(3-0) F. The study of modern inorganic chemistry from the point of view of the chemical bond, molecular structure, and spectroscopy. The course is built upon several topics chosen from group theory, molecular symmetry, molecular orbital and crystal field theories, electronegativity, solid state, magnetic properties, electronic adsorption, ORD, CD, and MCD. Mossbauer, nmr, nqr, ESCA, photoelectron, and vibrational spectroscopies.

CH 503 Inorganic Chemistry II. Preq: CH 501. 3(3 0) S. This course is a continuation of CH 501 and rests heavily upon the latter. Knowledge of physical methods of investigation is employed in order to understand the basis and systematize the chemistry of representative elements, transition metals (3d, 4d, 5d), lanthanides and actinides. Methods of synthesis are discussed and reasons for their success given, and for these reasons areas of discussion are chosen from nonaqueous solvents, acids and bases, inorganic reaction mechanisms of importance or contemporary interest, solid state reactions, coordination chemistry including chelates and organometallic compounds, crystal field stabilization energy, Jahn-Teller and trans effects, stabilization of valence states, and some bio inorganic chemistry.

CH 511 Chemical Spectroscopy. Preq: CH 433. 3(3-0) F. Theory, analytical applications and interpretation of spectra as applied to chemical problems. Major emphasis will be placed upon ultraviolet, visible and infrared spectra. Offered F 1980 and alt. years.

CH 515 Chemical Instrumentation. Preq: CH 431; Coreq: CH 411. 3(3-0) S. Basic electronic components and circuits, the response of laboratory instruments, design and modification of typical electronic control and measurement systems. Emphasis will be placed on the transducers and control elements utilized in chemical research.

CH 517 Physical Methods of Elemental Trace Analysis. Preq: CH 315 or 331 or Cl. 3(3-0) F. The principles and applications of currently used methods of trace analysis are presented. Designed for students with little or no experience in trace analysis but with a strong interest in or need for analytical data at the trace level. Topics include pulse polarography, potentiometry, UV-Vis spectrophotometry, atomic absorption, emission spectrometry, fluorescence, neutron activation analysis, and spark source mass spectrometry.

CH 518 Trace Analysis Laboratory. Coreq: CH 517 or Cl. 2(0-6) F. The trace element content of samples is determined by a variety of instrumental techniques including UV-Vis spectrophotometry, fluorescence, emission spectrometry, atomic absorption, pulse polarography, and neutron activation analysis.

CH 521 Advanced Organic Chemistry I. Preqs: CH 223, 433 or 435. 3(3-0) F. Structure, stereochemistry and reactions of the various classes of hydrocarbons. The molecular orbital treatment of bonding and reactivity of alkenes, the conformational interpretation of cycloalkane and cycloalkene reactivity, and the application of optical isomerism to the study of reaction mechanisms will be emphasized.

CH 523 Advanced Organic Chemistry II. Preq: CH 521. 3(3-0) S. An introduction to acid-base theory and mechanistic organic chemistry as applied to synthetically useful organic reactions.

CH 525 Physical Methods in Organic Chemistry. Preqs: CH 223 and 433 or 435. 3(3-0) S. Application of physical methods to the solution of structural problems in organic chemistry. Emphasis will be on spectral methods including infrared, ultraviolet, nuclear magnetic resonance, mass spectrometry, electron paramagnetic resonance, X-ray and electron diffraction, and optical rotatory dispersion.

CH 531 Chemical Thermodynamics. Preqs: CH 433, MA 301. 3(3 0) F. An extension of elementary principles to the treatment of ideal and real gases, ideal solutions, electrolytic solutions, galvanic cells, surface systems and irreversible processes. An introduction to statistical thermodynamics and the estimation of thermodynamic functions from spectroscopic data.

CH 533 Chemical Kinetics. Preqs: CH 433, MA 301. 3(3-0) S. An intensive survey of the basic principles of chemical kinetics with emphasis on experimental and mathematical techniques, elements of the kinetic theory, and theory of the transition state. Applications to gas reactions, reactions in solution and mechanism studies. (Offered S 1979 and alt. years.)

CH 535 Surface Phenomena. Preqs: CH 433, MA 301. 3(3-0) S. An intensive survey of the topics of current interest in surface phenomena. Formulations of basic theories are presented together with illustrations of their current applications. (Offered S 1980 and alt. years.)

CH 537 Quantum Chemistry. Preqs: MA 301, CH 435, or PY 407. 3(3-0) S. The elements of wave mechanics applied to stationary energy states and time dependent phenomena. Applications of quantum theory to chemistry, particularly chemical bonds.

CH 539 Colloid Chemistry. Preq: CH 220, 315 or 331, or CI. 3(2 3) S. Theories, basic principles and fundamental concepts including preparation and behavior of sols, gels, emulsions, foams, and aerosols; and topics in areas of adsorption, Donnan equilibrium, dialysis and small-particle dynamics. Laboratory includes independent project studies in specialized areas. (Offered S 1979 and alt. years.)

CH 545 Radiochemistry. Preq: PY 410 or CH 431. 3(2-3) S. The applications of radioactivity to chemistry and the applications of chemistry to the radioactive elements, particularly the transuranium elements and fission products. (Offered S 1980 and alt. years.)

CH (TC) 562 Physical Chemistry of High Polymers—Bulk Properties. 3(3-0) F. (See textile chemistry.)

CHEMICAL ENGINEERING

CHE 205 Chemical Process Principles. Preqs: CH 107, MA 201. 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. Felder

CHE 225 Chemical Process Systems. Preq: PY 208; Coreq: MA 301. 4(3-2). F,S. Process measurements of importance in chemical engineering: temperature, pressure, flow rate, level, concentration. Static calibration of measuring instruments. An introduction to process dynamics and control via theory and experiment. Marsland

CHE 301, 302 Elements of Chemical Engineering. Preq: (301) MA 212; (302) CHE 301. 3(3-0) F,S. Principles including calculations involved in industrial processes and equipment. For students not majoring in CHE. Seely

CHE 311 Transport Processes I. Preqs: MA 301, PY 208, CHE 205. 3(3 0) F,S. Momentum and heat transfer with emphasis on applications in chemical processing. Problems in the design of fluid flow systems and heat exchangers. Rousseau

CHE 315 Chemical Process Thermodynamics. Preqs: CHE 205, MA 301. 3(3-0) F,S. The 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.

Hopfenberg

CHE 316 Thermodynamics of Chemical and Phase Equilibria. Preq: CHE 315. 3(3-0) S. Thermodynamics is the principal tool for systematic study of chemical reaction equilibria and phase equilibrium. Fugacity, activity and chemical potential as methods for predicting the effect of temperature, pressure, etc. on equilibrium compositions. Methods for measuring and estimating thermodynamics properties important to equilibrium calculation in real systems.

Hopfenberg

CHE 325 Introduction to Plastics. Preq: CH 103. 3(3-0) F.S. Survey of plastics and polymers: types, applications, fabrication, processing and testing.

Seely

CHE 327 Separation Processes I. Preq: CHE 311. 3(3-0) S. Applying principles of transport phenomena to the unit operations of absorption, extraction, distillation, drying, filtration, etc. with emphasis on design procedures and economic consideration.

Rousseau

CHE 330 Chemical Engineering Lab I. Preq: CHE 205; Coreq: CHE 311. 2(0-4) F. Laboratory experiments in unit operations that augment the theory and data of CHE 311, Transport Processes I, in the areas of momentum and heat transfer. An added emphasis is on technical report writing.

Seely

CHE 331 Chemical Engineering Lab II. Preq: CHE 330; Coreq: CHE 327. 2(0-4) S. A continuation of Chemical Engineering Lab I with emphasis on report writing and on the unit operation of absorption, extraction, distillation, drying, etc.

Seely

CHE 412 Transport Processes II. Preq: CHE 327. 3(3-0) S. Momentum, heat and mass transport processes, with emphasis on CHE. Problems in fluid, heat and mass transfer.

Ferrell

CHE 425 Process Measurement and Control I. Preqs: CHE 225, 327. 3(2-2) F. The continuous control of typical chemical engineering processes including the techniques of feedback, cascade, feedforward and interacting systems. Dynamics, stability, and control of heat exchangers, flow systems, distillation columns and chemical reactors.

Helt

CHE 426 Process Measurement and Control II. Preq: CHE 425 or EE 435 or MAE 435. 3(2-2) S. An extension of the theory and application of process control techniques to the analysis of physical systems. Sampled data and nonlinear systems and an introduction to optimum control techniques and adaptive control.

Martin

CHE 432 Chemical Engineering Lab III. Preq: CHE 431. 2(0-4) F.S. Projects in research, design or development in various areas of chemical engineering.

Seely

CHE 446 Chemical Process Kinetics. Preq: CHE 315. 3(3-0) F. The characterization and measurement of the rates of homogeneous and heterogeneous reactions. The design and analysis of chemical reactors.

CHE 451 Chemical Engineering Design. Preqs: CHE 315, 327, 432. 3(2-2) F.S. Chemical process design and optimization. The interplay of economic and technical factors in process development, site selection, project design, construction and production management. Applications of cost accounting, cost estimation for new equipment, measures of profitability.

Marsland

CHE (BAE) 465 Introduction to Biomedical Engineering. Preqs: MA 202 or 212, PY 212 or 221. 3(3-0) F. Engineering applications to biomedical problems such as flow in the cardiovascular and respiratory systems; transfer of thermal energy in and from warm-blooded animals; transport of materials through physiological tissues and membranes, and performance of organ replacement and assist devices such as the artificial kidney and the intra-aortic balloon.

Beatty

CHE 495 Seminar in Chemical Engineering. Preq: Senior standing. 1(1-0) F.S. Professional aspects and topics of current interest.

Staff

CHE 497 Chemical Engineering Projects. Preq: Senior standing. 1-3 F.S. Introduction to research through experimental, theoretical and literature studies of CHE problems. Oral and written presentation of reports.

Staff

Selected 500-Level Courses Open To Advanced Undergraduates

CHE 511 Chemical Engineering Process Modeling. Preqs: CHE 311, CHE 327, MA 301. 3(3-0) S. The application of the methods of mathematical analysis to the formulation and solution of problems in transport phenomena, process dynamics and chemical reaction engineering. Felder

CHE 513 Thermodynamics I. Preq: CHE 315, 316. 3(3-0) F. An intermediate course in the application of thermodynamic principles to problems arising in the chemical process industries. Chemical reactions and phase separation operations are viewed from a thermodynamic standpoint including consideration of their energy efficiencies. Beatty

CHE 515 Transport Phenomena. Preq: CHE 311, 327. 3(3-0) S. A theoretical study of transport of momentum, energy and matter with emphasis on the latter two. The diffusional operations are introduced in the light of the theory. Marsland

CHE 517 Kinetics and Catalysis. Preq: CHE 446. 3(3-0) F. Rates of homogeneous and heterogeneous chemical reactions; experimental methods and mathematical techniques used in the acquisition and analysis of rate data and the design of chemical reactors. Stahel

CHE 521 Mass Transfer Operations. Preq: CHE 327 or equivalent. 3(3-0) S. The theory and practice of staged multicomponent mass transfer operations and continuous rate processes. Problems unique to specific operations such as extractive and azeotropic distillation are discussed. Rousseau

CHE 523 Fluid Dynamics and Heat Transfer. Preq: CHE 311. 3(3-0) F. Convective heat transfer in chemical process equipment, such as heat exchangers, chemical reactors, distillation and extraction reboilers, etc., and fluid dynamics and heat transfer in multiphase, multicomponent and chemically reactive systems. Ferrell

CHE 525 Chemical Process Control. Preq: CHE 425. 3(3-0) S. The application of control techniques to sampled data chemical process systems. Z-transform and state variable methods for the determination of open loop and closed loop system responses and for the synthesis of controller algorithms. Hybrid computer simulation and control of on-line real time processes. Ferrell

CHE (OR) 527 Optimization of Engineering Processes. Preqs: CHE 451 or OR 501, FORTRAN programming. 3(3-0) F. The formulation and solution of process optimization problems, with emphasis on nonlinear programming techniques. Computer implementation of optimization algorithms, and structuring of process models to increase computational efficiency. Felder

CHE 535 Engineering Economy in Air Pollution Control Systems. Preqs: MAE 409, CE 576 or equivalent first course. 3(3-2) F. Design of equipment for the abatement of air pollution; estimation of capital cost and operating expense; economic optimization under various kinds of tax laws. Marsland

CHE 541 Cellulose Industries. Preq: Organic chemistry. 3(3-0) F. Methods of manufacture and application of cellulose chemical conversion products. Recent developments in the field of synthetic fibers, film, lacquers and other cellulose compounds. Seely

CHE 543 Technology of Polymers. Preq: CH 223. 3(3-0) S. Concepts and techniques of macromolecule characterization. Structure, properties, fabrication technology and applications of commercially important polymers. Koros

CHE 561 Biomedical Engineering I: Fluid Flow and Heat Transfer. Preq: CHE (BAE) 465 or equivalent background. 3(3-0) S. The physiology requisite to modeling and analysis of mammalian systems, coupled with the engineering approach to the biomedical problems of flow of fluids (blood, lymph, air, etc.) in the body and thermal transport from the body surfaces. Beatty

CHE (TC) 569 Polymers, Surfactants and Colloidal Materials. Preqs: CHE 316, CH 223. 3(3-0) F. Relationships between molecular structure and bulk properties of nonmetallic materials as applied in chemical engineering processes. Applications of surface and colloid chemistry and polymer science to product development and processes improvement. Hopfenberg

CHE (TC) 570 Radiation Chemistry and Technology of Polymeric Systems. Preqs: CH 221, 431, 3(3-0) S. Principles and practice of isotope and electron beam radiation treatment. Applications of high energy radiation in polymer chemistry and technology, including the use of radiation to cross link and degrade polymers. Similarities and differences between radiation polymerization and photopolymerization. Stannett, Williams

CROP SCIENCE

CS 211 Crop Science. Preq: BS 100. 4(4 0) F.S. Fundamental morphological, physiological and reproductive features of crop plants and the management practices for economical production. Emery, Fike

CS 214 Crop Science Laboratory. Preq: or Coreq: Any CS course. 1(0-2) F.S. (Can be taken only once for credit.) Evaluates methods of identifying and dealing with the problems of growing and managing crop plants. Emery, Fike

CS 295 Special Topics in Crop Science. Preq: CS 211 or BO 200. 1-6 F.S.Sum. To be used for intensive or extensive study of specific crop science principles or production practices. It may also serve as a means for presenting crop science topics of current interest to non-majors. Emery

CS 312 Pastures and Forage Crop. Preqs: BS 100, SSC 200 recommended. 3(3-0) S. Production and preservation of the principal forage crops, with attention to the development and maintenance of pastures. Chamblee

CS 315 Turf Management. Preq: BS 100. 3(2 2) S. Production, utilization, and management of turf grasses. The growth responses of different plant species to natural and imposed environmental factors. Interrelationships of climate, soil, biotic factors, and plants are examined in the field, laboratory, and classroom. Gilbert

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. Emery

CS 414 Weed Science. Preq: CH 220. 4(3-2) F. Introduction to weed science covering principles and practices of cultural, biological, and chemical control. Chemistry, properties and effects of herbicides on plants are studied. Weed identification and principles and practices of application of herbicides and their safe use are covered. There are three parts of lecture content: introduction, history, fundamentals of weed growth, spread and control; a section on chemical herbicides; and a section on weed control practices in crops and noncropland areas. Worsham

CS (SSC) 462 Soil-Crop Management Systems. Preqs: CS 211, 414, SSC 341, 352. 3(2-3) S. (See soil science.)

CS 490 Senior Seminar in Crop Science. Preq: Senior in Crop Science or related field. 1(1 0) S. The collection, organization, written preparation, and oral delivery of scientific information in Crop Science and related fields.

Selected 500-Level Courses Open To Advanced Undergraduates

CS 511 Tobacco Technology. Preq: BO 421 or equivalent. 3(3-0) S. A study of special problems concerned with the tobacco crop. The latest research problems and findings dealing with this important cash crop will be discussed. Collins

CS 513 Physiological Aspects of Crop Production. Preq: BO 421. 3(3-0) S. Discussion will emphasize pertinent physiological processes associated with crops and crop management such as plant growth, maturation, respiration and photoperiodism. Relationship of the environment to maximum crop yields will be discussed. (Offered in S 1980 and alt. years.) Fike

CS (HS) 514 Principles and Methods in Weed Science. Preq: CS 414 or equivalent. 3(2-2) S. Studies of the losses caused by the ecology of weeds, biological control basic concepts of weed management, herbicide-crop relationships and herbicide development. Introduction to greenhouse and bioassay techniques and field research techniques. Monaco

CS (GN, HS) 541 Plant Breeding Methods. Preqs: GN 506, ST 511. 3(3-0) F. An advanced study of methods of plant breeding as related to principles and concepts of inheritance. Henderson, Wynne

CS (GN, HS) 542 Plant Breeding Field Procedures. Preq: CS (GN, HS) 541. 2(0-4) Sum. Laboratory and field study of the application of the various plant breeding techniques and methods used in the improvement of economic plants. (Offered in Sum. by arrangement.) Graduate Staff

CS (GN) 545 Origin and Evolution of Cultivated Plants. Preq: CS (GN, HS) 541 or GN (ZO) 540. 2(2-0) S. Discussion topics include: mankind as a potential cultivator; man's anatomy, physiology and alimentary needs; origins of cultivation; spread of agriculture in terms of various theories; interactions of crops and environments with reference to crop evolution; special attributes of cultigens; modern aspects of evolution (breeding). (Offered S 1980 and alt. years.) Lee

CS 591 Special Problems. Preq: CL Credits Arranged. Special problems in various phases of crop science. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research. Graduate Staff

COMPUTER SCIENCE

CSC 101 Introduction to Programming. 3(2-2) F,S. Understanding algorithms, programs and computers. Organization and characteristics of computers. Fundamental algorithms associated with computing. Data representation. Basic programming and program structure. Debugging and verification of programs. Computer solution of numerical and non-numerical problems using one or more programming languages.

CSC 102 Programming Concepts. Preq: CSC 101. 3(3-0) F,S. The features available in high-level programming languages. The student develops good programming habits by writing a variety of non-numerical application programs. Emphasis is on the global properties of programs in a block-structured language with list and string manipulation facilities.

CSC 111 Introduction to FORTRAN Programming. 2(2-0) F,S,Sum. An introductory FORTRAN programming course for non-majors. Emphasis is on fundamental elements of problem-solving using the computer. Particular elements include: careful systematic development of algorithms; translation of algorithms into programs written in standard FORTRAN; documentation of programs, debugging, and testing; facilities of modern computer systems.

CSC 200 Introduction to Computers and Their Uses. (A student who has taken CSC 101 or 111 may not receive credit.) 3(3-0) F,S. An introduction to electronic digital computers, including the parts of a computer, a step-by-step description of the processes which the computer goes through in performing its tasks, and description of several uses to which the computer is currently being put. Intended for non-technical students desiring knowledge of computer capabilities and limitations.

CSC 201 Basic Computer Organization and Assembly Language. Preq: CSC 101 or CSC 111. 3(3-0) F,S,Sum. This course covers basic computer capabilities, basic computer organization, central processing units, main memory, address structure, data representation, error conditions, input, output and auxiliary storage devices, symbolic coding and assembly systems, subroutines, and systems software.

CSC 202 Concepts and Facilities of Operating Systems. Preq: CSC 201 or equivalent. 3(3 0) F,S. This course covers the history of operating systems, basic macro concepts, program management services, interrupt handling, memory addressing and allocation, input/output devices, data set characteristics and identification, data set access techniques, error handling, processing of data sets, space allocation for data sets, data set control and disposition, and the basic characteristics and use of time sharing facilities.

CSC 251 Principles of Programming—Fortran. Preq: CSC 111 or 102. 1(1-0) S. The programming language Fortran and its applications to numerical computation and file manipulation. Emphasis on features and restrictions which are unique to Fortran. Programming assignments which explore the language in depth (Grading S-NC).

CSC 252 Principles of Programming Cobol. Preq: CSC 101. 1(1-0) F,S. Introduction to the business-oriented programming language Cobol. Programming assignments cover general data processing, file maintenance and report generation. (Grading S-NC).

CSC 253 Principles of Programming Algol. Preq: CSC 102. 1(1-0) F. Algol 60 presented as a theoretical construct and a practical programming language. Extensions to Algol 60. Programming problems in a variety of applications areas. (Grading S-NC).

CSC 254 Principles of Programming—APL. Preq: MA 405. 1(1-0) S. 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. (Grading S-NC).

CSC 255 Principles of Programming Snobol. 1(1-0) F. The syntax and semantics of the symbol manipulation language Snobol 4. Applications of the language to programming problems in non-numeric areas. (Grading S-NC).

CSC 256 Assembly Language Programming. Preq: CSC 201. 2(2-0) S. This course is designed to give the student an understanding of the IBM 360/3/0 assembly language. Topics will include: Basic programming concepts such as base register usage, looping, address modification; input-output using system macros; use of other system macros; subroutines; re-entrant coding; interrupt handling; and linking assembly language programs to higher level languages.

CSC 302 Introduction to Numerical Methods. Preqs: CSC 101 or 111, MA 201 or MA 212; Coreq: MA 202. 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 311 Data Structures. Preq: CSC 102 and 201. 3(3-0) F,S. Fundamental algorithms associated with data structures. Topics are: linear lists including stacks, queues and deques; sequential and linked allocation of linear lists; circular lists, doubly-linked lists, arrays and orthogonal lists; trees including traversal of binary trees and binary representation of trees; lists and garbage collection; multilinked structures; dynamic storage allocation.

CSC 312 Computer Organization and Logic. Preqs: CSC 201, 322. 3(3-0) F,S. Application of Boolean algebra to combinational circuit design problems. Sequential circuits. Organization and functional design of simplified computer components such as the memory unit, the arithmetic and logic unit and input-output devices. Architecture of computing systems. Functional characteristics of I/O devices, data channels, interrupt and priority systems. Microprogram control. Hardware-software tradeoffs and firmware.

CSC (E) 321 Computer Graphics. Preqs: MA 202 or 212 and CSC 101 or 111. 3(2-2) S. (See engineering, general courses.)

CSC 322 Applied Algebraic Structures. Preq: MA 405. 3(3-0) F,S. Naive set theory, order and equivalence relations, functions, partitions, operations and congruences. Boolean algebra, semi-group, group and graph theory. Logic of propositions, first order predicate calculus, models for an axiomatic theory. Some applications and examples of these algebraic structures selected from formal language description, data structures, file organization, information retrieval, games, switching circuits, neural nets, sequential machines, artificial intelligence, syntactic structure of arithmetic expressions and theory of algorithms.

CSC 351 Principles of Programming—LISP. Preq: CSC 311. 1(1-0) F. The programming language LISP and its application to the processing of general lists structures, with emphasis on recursive programming. Assignments demonstrate the power and versatility of LISP. (Grading S NC).

CSC 401 Sorting and Searching. Preq: CSC 311. 3(3-0) F. Sorting and searching procedures and their implications for file structure design. On line and batch processing systems.

CSC 405 Introduction to Systems Programs. Preqs: CSC 202, 256, 311. 3(3-0). F. This course is concerned with the functions, structure, problem areas, and history of development of assemblers, macro processors, loaders, linkage editors, interrupt handlers, and current production-type operating systems, plus the effects of varied computer architecture on systems programs, and specialized programming techniques used in constructing systems programs.

CSC 411 Introduction to Simulation. Preqs: MA 202, ST 371 or equivalent and programming language proficiency. 3(3-0) F.S. Introduces simulation concepts and methodology to CSC and other students. Modeling and computational techniques, Monte Carlo methods and interactive simulation. Projects are developed in areas of student interest.

CSC 412 Introduction to Computability, Language and Automata. Preq: CSC 322. 3(3-0) F.S. Sequential machines as abstractions of digital computers described by state-transition graphs. Sequential machine as language acceptors and as the finite control of a Turing machine. Chomsky classification of languages and machines. Universal Turing machines and the halting problem. Church's thesis. Recursive functions. Heuristic argument that a function is recursive if and only if it is Turing computable. The semi-group word problem and tree searching algorithm. Applications to artificial intelligence, perceptron simulation, game playing, syntactic analysis algorithms.

CSC 421 Computer Systems for Management. Preq: CSC 311. 3(3 0) F. Management information systems (MIS). The data base approach. Characteristics of successful systems and dimensions of system evolution and evaluation. Models versus modeling in MIS design. A model of information flow and its economics. Profitability and risk analysis in corporate financial systems. Production/inventory control through MIS. Operations research techniques for MIS development. Management's MIS consultant. The general purpose MIS. Human factors in design and implementation of the new company MIS.

CSC (MA) 427 Introduction to Numerical Analysis I. Preqs: MA 301 or 312 and programming language proficiency. 3(3-0) F. For undergraduate students in any department who wish to learn the theory and practice of computational procedures using a digital computer. Topics include: approximation of functions by interpolating polynomials; numerical differentiation and integration; solution of systems 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. 3(3-0) S. For students who wish to learn computational procedures using digital computers. Topics include: solution of linear and nonlinear equations; matrices and eigenvalue calculations; orthogonal polynomials and Gaussian quadrature; curve fitting and function approximation by least squares; smoothing formulas; minimax approximations. [CSC (MA) 427 is not a prerequisite.]

CSC 431 Information Retrieval. Preq: CSC 311. 3(3-0) S. Organization and retrieval of information in natural language form. Analysis of information content by statistical, syntactic and logical methods. Automatic clustering and statistical association methods. Dictionary construction and utilization. File organization and retrieval techniques for text processing systems. Evaluation of retrieval effectiveness. Applications to both document retrieval and question answering systems.

CSC 432 Introduction to Digital Signal Processing. Preqs: CSC 302, ST 371, and MA 405. 3(2-2). Use of digital computers in the processing of analog signals. The uses of operational amplifiers in SAH, DAC, and ADC's and other data acquisition devices. The discrete Fourier transform, digital filters and other algorithms used in processing time series.

CSC 462 Computing for the Social Sciences. Preq: ST 311 or equivalent. 3(3-0) F.S. To acquaint the social scientist with the information processing capabilities of a computer. Examples and problems from the social sciences. Topics include: a higher level programming

language, procedures for accessing statistical packages and other library routines, and data management using disks and tapes. (CSC majors may not receive credit.)

CSC 495 Special Topics in Computer Science. Preq: CI. 1-6 F,S. 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 Undergraduate Research in Computer Science. Preq: CI. 1-6 F,S. Independent investigation of a research problem under faculty supervision.

Selected 500-Level Courses Open To Advanced Undergraduates

CSC 504 Application of Linguistic Techniques to Computer Problems. Preq: CSE 502. 3(3-0) S. Semiotics and programming languages. Comparison of semantic theories. Representation, classification and interpretation of scenes and other multi-dimensional illustrations. Design of a formal language for describing two-dimensional geometric figures, such as flowcharts, chemical structures and logic diagrams. Characterization of programming languages according to the theory of transformational grammar.

CSC 532 Artificial Intelligence II. Preqs: CSE 511, course in mathematical logic. 3(3-0) S. A rigorous approach to artificial intelligence emphasizing pattern recognition, theorem proving, game playing, learning and heuristic programming. Students will be assigned computer projects illustrating theoretical concepts introduced in lecture.

CSC (MA) 582 Special Topics in Numerical Solution of Linear Algebraic Equations. Preqs: MA 405 or equivalent and a knowledge of computer programming. 3(3-0) S. A mathematical and numerical investigation of direct iterative and semi-iterative methods for the solution of linear systems. Methods for the calculation of eigenvalues and eigenvectors of matrices.

CSC (MA) 583 Special Topics in the Numerical Solution of Ordinary Differential Equations. Preq: Knowledge to the level of CSC 427. 3(3-0) S. Numerical methods for initial value problem including predictor-corrector, Runge-Kutta, hybrid and extrapolation methods; stiff systems; shooting methods for two-point boundary value problems; weak, absolute and relative stability results.

CSC (MA) 584 Special Topics in the Numerical Solution of Partial Differential Equations. Preq: Knowledge to the level of CSC 427-428. 3(3-0) F. Numerical methods for the solutions of parabolic, elliptic, and hyperbolic partial differential equations including stability and convergence results.

CSC (OR) 585 Graph Theory. Preq: MA 405. 3(3-0) F. Basic concepts of graph theory. Trees and forests. Vector spaces associated with a graph. Representation of graphs by binary matrices and list structures. Traversability. Connectivity. Matching and assignment problems. Planar graphs. Colorability. Directed graphs. Applications of graph theory with emphasis on organizing problems in a form suitable for computer solution.

CSC 595 Special Topics. Preq: CI. 1-6 F,S. Topics of current interest in computer science not covered in existing courses.

COMPUTER STUDIES

CSE 452 through CSE 459 are fast paced one credit courses that are abbreviated from regular 3-credit undergraduate courses on this campus. They are structured primarily for students with a bachelor's degree in one of the quantitative sciences, but with little computer background. Some proficiency in a high level programming language is assumed.

CSE 452 Assembly Language and Basic Computer Organization. Preqs: Higher level programming language and consent of the instructor. No degree credit for Computer Science or Computer Studies majors or anyone having received credit for CSC 201 or CSC 256. 1(1-0) F. Basic computer capabilities, basic computer organization, central processing units, main memory, addressing techniques, data representation, error conditions, input, output, symbolic coding, and subroutines.

CSE 453 Data Structures. Preqs: Higher level programming language and consent of the instructor. Coreq: CSE 452 or equivalent. No degree credit for Computer Science or Computer Studies majors or anyone having received credit for CSC 311. 1(1-0) F. An introduction to data structures and the fundamental algorithms associated with their use. Topics considered include: linear lists including stacks, queues, and deques. Sequential and linked allocation of linear lists. Circular lists, arrays and orthogonal lists. Trees. Garbage collection. Dynamic storage allocation.

CSE 454 Computer Organization and Logic. Preqs: CSE 452 or equivalent and CI. No degree credit for Computer Science or Computer Studies majors or anyone having received credit for CSC 312. 1(1-0) S. Application of Boolean Algebra to combinational circuit design problems. Sequential circuits. Organizational and functional design of simplified computer components such as the memory unit, the arithmetic and logic unit and input-output devices. Architecture of computing systems. Functional characteristics of I/O devices, data channels, interrupt and priority systems, microprogram control. Hardware software tradeoffs and firmware.

CSE 455 Applied Algebraic Structures. Preqs: MA 201, higher level programming language and consent of the instructor. No degree credit for Computer Science or Computer Studies majors or anyone having received credit for CSC 322. 1(1-0) F. Mathematical reasoning, sets, binary relations on sets, equivalence relations and partitions, functions, counting techniques, analysis of algorithms, infinite sets, countable and uncountable sets, cardinal arithmetic. Some examples and applications of these algebraic structures are selected from formal language theory, file organization, information retrieval, switching circuits, sequential machines, and artificial intelligence.

CSE 456 Introduction to Computability. Preqs: CSE 455 or equivalent and consent of the instructor. No degree credit for Computer Science or Computer Studies majors or anyone having received credit for CSC 412. 1(1-0) S. Sequential machines as abstractions of digital computers described by state-transition graphs. Universal Turing machines and the halting problem. Church's thesis. Chomsky classification of languages and machines.

CSE 457 Electric Circuits. Preqs: MA 202, PY 208, B average in mathematics and physics. No degree credit for electrical engineering or computer studies majors or anyone having received credit for EE 201, 202, 331, 332. 1(1-0) F. Circuit parameters, laws and theorems, transient analysis, and transformer principles. The course will meet three hours each week for the first five weeks of the semester.

CSE 458 Electronic Circuits. Preq: CSE 457. No degree credit for electrical engineering or computer studies majors or anyone having received credit for EE 314. 1(1-0) F. Diodes, transistors, circuit models, operational amplifiers, frequency response, latches, data conversion. This course will meet three hours each week for the middle third of the semester.

CSE 459 Linear Systems. Preqs: CSE 458, B average in physics. No degree credit for electrical engineering or computer studies majors or anyone having received credit for EE 301. 1(1-0) F. Signals, transfer functions and time response, stability. This course will meet three hours each week for the final five weeks of the semester.

Selected 500-Level Courses Open To Advanced Undergraduates

CSE 501 Design of Systems Programs. Preqs: CSC 311, 312 (CSC 301 recommended). 3(3-0) F. Review of batch process systems programs, their components, operating characteristics, user services and their limitations. Implementation techniques for parallel processing of input-output and interrupt handling. Overall structure of multiprogramming systems on multi-processor hardware configurations. Details on addressing techniques, core management, file system design and management, system accounting, and other user-related services. Traffic control, interprocess communication, design of system modules, and interfaces. System updating, documentation and operations.

CSE 502 Computational Linguistics. Preq: CI. 3(3-0) F. Natural language processing by computer. Finite-state, context-free, context sensitive and transformational grammars. Parsing mechanisms including augmented transition networks. Analysis of complex English sentences. Question-answering systems.

CSE 505 Design and Analysis of Algorithms. Preq: CSC 311 or CSE 453. 3(3-0) F. Study of techniques for the design of algorithms. Complexity and analysis of algorithms. Study of algorithms for certain classical problems that include sorting, searching, graphs, numerical algorithms and pattern matching.

CSE 506 Digital Systems Architecture. Preq: EE 340 or CSC 312 or CSE 454. 3(3-0) S. Digital systems architecture is the middle ground on which the interests of software, hardware and firmware come together. Among the topics considered are: architectural descriptions, storage systems, I/O systems, stack machines, and parallelism. The structure of digital systems implementation will also be considered as it relates to architecture.

CSE 510 Software Engineering. Preqs: CSC 311 and CSC 322 or CSE 453 and CSE 455 or equivalent. 3(3-0) F. The course will introduce the principles and methods for the design, coding, and validation of software systems. Among the topics covered are: software design techniques, programming methodology, program testing, proofs of program correctness, software reliability, and software management.

CSE 511 Artificial Intelligence. Preq: CSC 311. 3(3-0) F. Definition of heuristic versus algorithmic methods, rationale of heuristic approach, description of cognitive processes. Objectives of work in artificial intelligence, simulation of cognitive behavior. Heuristic programming techniques. Survey of examples from representative application areas. The mind brain problem and the nature of intelligence. Individual projects to illustrate basic concepts.

CSE 512 Metaprograms. Preq: CSC 311 (CSC 412 recommended). 3(3 0) S. This course is intended to provide a detailed understanding of the techniques used in the design and implementation of compilers. Introduction to formal grammars and relations concerning a grammar. Detailed study of algorithms for lexical scanners, top-down recognizers, bottom-up recognizers for simple precedence grammars, operator precedence grammars, high order precedence grammars, and bounded-context grammars. Runtime storage organization for a compiler including symbol tables, internal forms for source programs, semantic routines, error recovery and diagnostics, code generation and optimization, and interpreters.

CSE 522 Formal Languages and Syntactic Analysis. Preq: CSC 412 (CSC 512 recommended). 3(3-0) F. Detailed study of formal languages and their relation to automata: languages and their representation, grammars, finite automata and regular grammars, context free grammars and pushdown automata, type 0 grammars and Turing machines, the Halting Problem, context-sensitive grammars and linear bounded automata, and operations on languages.

CSE (MA) 529 Numerical Analysis I. Preqs: MA 405, MA 511 or equivalent. 3(3-0) F. Theory of interpolation, numerical integration, iterative solution of non-linear equations, numerical integration of ordinary differential equations, matrix inversion and solution of simultaneous linear equations.

CSE (MA) 530 Numerical Analysis II. Preq: CSC (MA) 529. 3(3-0) S. Least squares data approximation, expansions in terms of orthogonal functions. Gaussian quadrature, economization of series, minimax approximations, Padé's approximation, eigenvalues of matrices.

CSE (MA) 536 Theory of Sequential Machines. Preq: CSC 412 or grad. standing. 3(3-0) F. Sequential machine identification experiments. Finite-Memory machines. Special classes of machines. Decomposition of sequential machines. Linear sequential machines. Sequential relations of finite-state machines.

CSE (MA) 537 Theory of Computability. Preq: CSC 412 or grad. standing. 3(3-0) S. The concept of effective computability. Turing machines. Primitive recursive functions. The μ -operator. μ -recursive functions. Gödel numbering. Equivalence of Turing machines and μ -recursion. Undecidable predicates. Universal Turing machines. Other formulations of the concept of effective computability.

CSE 542 Database Management. Preq: CSC 431. 3(3-0) F. The course will cover the fundamentals of the area of database management. Basic topics will include: General architecture for database management systems; current data models such as network, relational, hierarchical; security and integrity; discussion of current implemented systems.

CSE (OR, IE) 562 Advanced Topics in Computer Simulation. Preqs: ST 421 or equivalent; or grad. standing. 3(3-0) S. Basic simulation methodology; general principles of the Monte Carlo method: random number generation, accuracy, variance reduction methods, classical applications in mathematics and physics; simulation of queueing systems; development of a research problem in depth where computer simulation is required 1) to provide insight through experimentation with a model, 2) to provide approximate answers and practical solutions, and 3) to test the model and the solutions.

CSE 571 Data Transmission/Communications. Preqs: CSE 454 or CSC 312 or EE 340; CSE 459 or EE 301. 3(3-0) S. Deals with the principles and techniques of moving digital data through transmission facilities. To be covered: digital information representation; characteristics of channels; modulation and demodulation (MODEM) techniques; error detection and correction; line control procedure; circuit, message and packet switching; multiplexors and concentrators.

CSE 572 Computer Communications. Preq: CSC 312 or EE 340 or CSE 454. Coreq: B average in technical subjects. 3(3-0) F. The purpose of this course is to enable the student to understand the principles, the control and operations, and the potential of computer communication systems; to present techniques for topological design and analytic modeling of such systems; and to provide the foundation for more detailed studies and research. The courses are self-contained and focus on practical applications of state-of-art techniques.

CSE 574 Real Time Computer Systems. Preq: CSC 405 or CSE 501. 3(3 0) Alt. S. Hardware and software characteristics of computer systems designed to meet specific response time requirements are studied. Topics include allocation of system resources including processor memory, disk, support I/O devices; synchronous and asynchronous event scheduling; effect of interrupts; static and dynamic priorities; implementation of queues; measurement of performance, especially scheduling and response accuracy.

CSE 591 Special Topics in Computer Studies. Preqs: B average in technical subjects and CL 3(3-0) F,S. Topics of current interest in computer studies not covered in existing courses.
Graduate Staff

DESIGN FUNDAMENTALS

(Also see Design.)

DF 101, 102 Environmental Design I, II. Preq: (DF 102) 101. Available to School of Design students only; this restriction may be waived by Dean and Program Director. 6(0 9) F,S. Introduction to the design disciplines and programs of the School of Design. A studio course examining the techniques and attitudes for dealing with identification, solution and evaluation arising from the design of physical artifacts in the natural and man-made environment. The acquisition of languages and skills appropriate to these studies.

DF 285 Environmental Design Studio for General Undergraduates. Preq: Sophomore standing. This course is not open to School of Design students. 3(0-6) F,S. A studio structured investigation of participant-context relationships as they help to determine the design of physical objects. Work involves the construction of various perceptual and conceptual simulations and/or models. Course places major stress on self-discovery and development.

DF 400 Advanced Design Studio. Preq: DF 102. Open only to School of Design Students. Restriction waived at discretion of Dean and Program Director. 6(0-9) F,S. Studio offering upper level undergraduates the opportunity to intensively study fundamental design issues (form, color, structure, proportion, scale, etc.) in a studio mode. Course may be used to partially satisfy studio requirement in all undergraduate programs in school.

DF 485 Design Studio for Non-Design Undergraduates. Preq: Junior standing. Not open to School of Design Students. 3(2 3) F,S. The course is intended to enrich the undergraduate program of students desiring some contact with the "studio" course structure of the School of Design. Design problems will be addressed in the studio milieu; the content of the problems will be drawn as much as possible from each student's major field of undergraduate studies.

DESIGN

(Also see Architecture, Design Fundamentals, Landscape Architecture, Product Design, Urban Design, Visual Design.)

DN 141 History of Design I. Open to University students on a space available basis. 3(3-0) F. A critical study of the related design fields from prehistoric to early Christian times with reference to the social, political and technological movements which affected their development.

DN 142 History of Design II. Open to University students on a space-available basis. 3(3-0) S. A critical study of the related design fields from early Christian to modern times with reference to the social, political and technological movements which affected their development.

DN 221 Introduction to Environment and Behavior for Designers. Credit in both DN 221/231 and DN 232 is not allowed. Students must concurrently enroll in DN 221 and 231. 3(3-0) F,S. An introductory integration of behavioral and environmental information, emphasizing a basic understanding of human behavior, natural systems, and their relation to environmental design. Examined is the impact of people and their artifacts on natural systems, and the impact of natural systems on people and their artifacts. Humane, ecologically sound utilization of these relations is explored.

DN 222 Human Perception and Behavior for Designers. 3(3-0) S. Course examines the linkages among perception, cognition and behavior with a strong emphasis on the perceptual mechanisms of humans, especially the eyes and ears. Also deals with the cognitive organization of perceptual information, its relation to language, society and culture and isolated human behavior at the micro and macro levels.

DN 231 Introduction to Environment and Behavior for Designers. (See DN 221.)

DN 232 Introduction to Natural Systems and the Built Environment. Credit in both DN 221/231 and DN 232 is not allowed. 3(3-0) F,S. This course is an introduction to natural systems and their integration into environmental design processes. Historical and present relationships between people and the physical environment are examined. Natural systems are analyzed as a foundation for environmental design decisions and ecologically sound habitation systems are explored.

DN 251 Principles of Architectural Structures. 3(3-0) F,S. Development of the principles of structural behavior. A survey of structural systems, both natural and man made, with an emphasis on a qualitative examination of the forces, influences or purposes to which they respond.

DN 252 Environmental Responses in Design. 3(3-0) S. An introductory study in form seen as a response between man and the natural environment. The morphological relationship between material properties and environmental energies and their dual impact on the shape of the built artifact is investigated.

DN 253 Basic Environmental Systems. 3(2-2) F,S. Natural and man made laws as applied to buildings and their various applications to lighting, heating, cooling, ventilation, plumbing, vertical transportation and sound.

DN 254 Architectural Materials and Construction Systems. 3(2-2) F,S. Development of the concept of building as an environmental control and response mechanism. A description of environmental and use factors upon which the science of building construction is based. An investigation of basic building materials, their properties, processes of production and principal systems of enclosure, consideration also given to economic factors and legal controls.

DN 255 Contemporary Manufacturing Processes I. 3(3-0) F. Introduction to mass production processes and their influences on design. Emphasis is placed on material search and process selection in relation to form, function, human factors, finishes and joining methods. An analysis of paper, wood and metal manufacturing processes utilized in the production of mass-produced products.

- DN 256 Contemporary Manufacturing Processes II.** 3(3-0) S. Introduction to mass production processes and their influences on design. Emphasis is placed on material search and process selection in relation to form, function, human factors, finishes and joining methods. An analysis of plastics and rubber and their specific manufacturing processes utilized in the production of mass-produced products.
- DN 257 Landscape Materials and Construction I.** 3(2-4) F. An option for those students wishing to concentrate on the use of materials in small scale physical design. The course will concentrate on the properties of materials in design and construction techniques. Exercises in design will stress the implementation and use of materials for particular situations.
- DN 258 Landscape Materials and Construction II.** 3(2-4) S. A continuation of DN 257 with an emphasis on material use and construction techniques; the development of construction documents; project organization and control and professional office organization will also be covered.
- DN 261 Design Methods.** 3(3-0) F. Description, comparisons, and testing of methods available in design with emphasis on problem-solving techniques.
- DN 349 Historic Architecture Research.** Preq: DN 141/142. 3 F.S. Research and the recording of sites, monuments, buildings or artifacts of historical interest.
- DN 351 Architectural Structures I.** Preq: or Coreq: DN 251. 3(3 0) F. An introduction to force systems, quantitative treatment of equilibrium conditions; analysis of forces in trusses, frames and beams; behavior of materials: stress-strain diagrams, ductility, brittleness, creep; mechanics of areas; column behavior; stresses and deflection in beams.
- DN 352 Architectural Structures II.** Preq: DN 351. 3(3 0) S. Selection of structural system and design of structural elements in wood, steel, concrete and aluminum.
- DN 411 Advanced Visual Laboratory.** Preq: DF 102, Sophomore standing, may be taken for a maximum of 12 credit hours. 2-4 F.S. Continuation, on an advanced level, of the activities encountered in Design Fundamentals that relate to the major design areas in the School of Design. Activities involve study of visual communication skills in areas of sculpture, life drawing, graphics, painting, photography. The student elects instructor and area(s) of activity.
- DN 413 Geometry for Designers.** Preq: DF 102. 3(2-3) F.S. An opportunity to explore and examine geometry and geometrization as applied to the various fields of physical design. Limited mathematical and drawing skills needed.
- DN 414 Color and Light Laboratory.** Preq: DF 102. 3(2-2) F.S. A course dealing with the physical and perceptual nature of color. It will be one-third lecture, one third studio and one-third discussion-seminar. Its purpose is to develop color awareness, sensitivity and skills in visual communication with color as a designer's tool.
- DN 415 Visual Design Materials and Processes I.** Preq: DF 102. 3(2-2) F. Introduction to basic tools and materials of visual design, packaging, typography and layout. The course will acquaint the student with mass production of two- and three-dimensional visual designs, packages and display techniques.
- DN 416 Visual Design Materials and Processes II.** Preq: DF 102. 3(2-2) S. Introduction to basic tools and materials of visual design, packaging, typography and layout. The course will acquaint the student with mass production of two- and three-dimensional visual designs, packages and display techniques.
- DN 417 Typography I.** Preq: DF 102. 3(2-2) F. Preliminary investigation into the uses of typography as a communications medium. Problems based on single sheet solutions, using both single and composite imagery and including such projects as posters, announcements, advertisements, and covers; type specification; and copyfitting.
- DN 421 Environmental Cognition for Designers.** Preq: DN 221/231 or DN 222. 3(3-0) F. A basic model of cognitive processes is examined, providing a framework for a lengthy exploration of cognitive imagery. This commences with body imagery and images of self, moving from there to developmental images of home, school, neighborhood and city. Mature imagery of similar things is studied, concluding with a model of the micro-genetic development of environmental imagery useful in design decision making.

DN 423 Spatial Cognition for Designers. Preq: DN 221/231 or DN 222. 3(3-0) F. The history of the concept of space in the Western world is examined as a foundation from which to look at how humans cognize space. A child developmental perspective is emphasized, but a model of spatial cognition in the adult is described. The relation of spatial to environmental cognition is treated.

DN 424 Social Factors Analysis in Design. Preq: DN 221 231 or 222. 3(2-4) S. The course introduces the student to human analysis techniques which can be applied to landscape architectural design. Interaction theory, neighborhood theory, social design policy and user preference approaches will be presented.

DN 430 Site Planning. Preq: DN 221 231 and GY 120/110 or GY 101/110 or SSC 205. 3(2-2) F.S. Introduction into the technical operations and environmental landscape controls on project scale developments. The course covers site analysis, road alignment, grading hydrologic control, sedimentation control and related problems of land development.

DN 431 Natural Environment Analysis. Preq: DN 221 231 or DN 232. 3(3-0) F. Course in the theory and methods of landscape description, assessment and analysis of natural environments. Environmental science applications are described in relationship to land planning and management.

DN 432 Environmental Assessment and Design Field Workshop. Preq: DN 221/231 or DN 232. 3 Sum. This summer field workshop is a hands-on experience concerned with the assessment of natural systems and their utilization in the active manipulation of the environmental setting. Experiments relating to alternative decentralized energy systems, energy conservation methods, and low technology, ecologically sound site support systems will be designed and executed.

DN 441 Origins and Development of Contemporary Architecture. Preq: DN 141, 142 for Design students only. Others: Junior standing. 3(3-0) F.S. 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. The work of significant architects are explored through lectures and slide presentations.

DN 443 Landscape History: From the Ice Age to the Present. Preq: DN 141, 142. 3(3-0) F. The landscape designer deals with a landscape that has been shaped by man for the past fifteen or so thousand years. What has been the nature of man's agency? How extensive have the changes he has wrought been? Course examines in depth the landscape impacts of agriculture, commerce and industry attempting to establish the context within which the landscape designer operates.

DN 444 History of Landscape Architecture. Preq: DN 141, 142. 3(3-0) F. The history of man's deliberate and conscious attempts to design the landscape is examined, beginning with a view of the efforts and results of primitive man. Ancient, medieval and Renaissance work is examined in garden and urban design to set the stage for the explosion of professional activity that followed. The work of Frederick Law Olmsted is examined in detail.

DN 445 Aesthetics and Design. Preqs: DN 141 or DN 142. 3(3-0) F. An examination of the identity, nature, and function of aesthetic experience, cognition, and action as related to the design disciplines and reflected in designed artifacts.

DN 447 Architecture History Seminar. Preq: DN 141, 142. 3(3-0) F.S. Presentations and discussions of specific areas in architectural history and allied design fields.

DN 451 Illumination. Preq: DN 253. 3(1-4) S. Design of illumination systems for interior space. Model simulation of alternative lighting schemes.

DN 452 Climate Control Systems and Design. Preq: DN 253. 3(1-4) F. Mechanical and non-mechanical systems for heating, cooling, ventilating interior of building with emphasis on energy conscious design.

DN 453 The Systems Approach to Building. Preq: DN 254. 3(3-0) S. An examination of a totally integrated process of programming, designing, constructing and evaluating buildings or larger environmental units. The history of industrialized building and case studies of significant systems building efforts of recent years will be investigated. Included will be an assessment of the future potentials of the systems approach and the designer's role.

DN 462 Predictive Techniques, Predesign Methods, and Programming. Preq: DN 261. 3(3-0) S. Problem solving, research methods, programming, games, graph theory and their applications to design.

DN 491 Special Seminar in Design. 1-3 F,S. Seminars on subjects of current interest in design which are presented by persons not part of the regular faculty.

DN 492 Special Topics in Design. 1-3 F,S. Topics of current interest to the programs in the School of Design offered by faculty in the School. Courses offered under this number are normally used to develop new courses.

DN 493 Mini-Course in Design. 1 2 F,S. Seminars, workshops and lectures which by nature of their subject matter, focus or method of instruction do not fit the semester model.

DN 494 Internship in Design. Preq: Junior Standing. Approval of program director. Max. 6 cr. hrs. 3-6 F,S. Supervised field experience in professional offices and organizations whose activities are related to the programs of the School of Design.

DN 495 Independent Study in Design. Preq: Junior Standing. Max. 6 cr. hrs. Approval of program director and core chairman. 1-3 F,S. Special problems in various aspects of design developed under the direction of a faculty member on a tutorial basis.

ENGINEERING (General)

E 101 Engineering Graphics I. 2(0-3) F,S. Graphical representation and solution of spatial problems. Emphasis is on development of logical and analytical approaches to problem solution. Conventional methods of graphically describing size and shape in the representation of basic mechanical elements. Practical engineering drawing applications are utilized. Course is taught using Self-Paced Instruction.

E 120 Engineering Concepts. Not open to jrs. and srs. in Engineering. 3(2-1) F,S. Students are involved in realistic freshman design projects. History, fields and functions of engineering, case studies, computational skills, and societal problems are covered. Staff

E 201 Spatial Relations and Vector Applications. Preq: First courses in graphics and physics. 3(2-2) S. Spatial representation of points, lines, and planes and the determination of the lengths, sizes, and angles that exist between these elements, with the application of these studies to vector systems. Webb

E 207 Engineering Graphics II. Preq: E 101. 2(1 3) F,S. Presentation of engineering data for use in the manufacturing process. Production dimensioning, detail and assembly production drawings, and free-hand sketching are covered. Special emphasis on sketching. Webb

E 220 Engineering and Contemporary Society. 3(3-0) F. Investigation of the role of engineering technology in modern life, with emphasis on technological factors involved in solution of national and world problems. Major topics such as energy, communication, materials, and transportation examined in terms of cultural and economic goals for the future. Staff

E 240 Furniture Graphics. Preq: E 101. 3(1-4) F. Furniture drawing and dimensioning. Special practices of furniture industry are covered. Free hand sketching is emphasized. Freeman

E 301 Graphical Solutions for Numerical Data. Preq: A first course in calculus. 3(2 2) F. Study of available graphic methods to represent and manipulate numerical data. Topics include: proper selection of coordinate systems and axes, empirical equations, curve fitting, graphical calculus, nomography, and design of special purpose slide rules. Computer applications demonstrated. Hammond

E (CSC) 321 Computer Graphics. Preqs: MA 202 or 212 and CSC 101 or 111. 3(2-2) S. Presentation of computer-graphic methods of data manipulation; which computer-graphic methods are available; when and how they can be applied. Three dimensional applications covered. Houck

E 432 Patents, Trademarks and Copyrights. Preq: Jr. standing. 3(3-0) S. Review of these laws in relation to engineering, scientific and industrial pursuits; individual inventors, authors, and companies; and Patent Office procedures and practice. Mills

E 492 Special Topics in Engineering. Preq: Jr. Standing. 1-3 F.S. Offered as needed for subject matter of a non-departmental nature.

E (OR) 531 Dynamical Systems and Multivariable Control. 3(3-0) F. (See operations research.)

ECONOMICS AND BUSINESS

(Also see Accounting.)

EB 201 Economics I. Credit will not be awarded for both EB 201 and EB 212. 3(3-0) F.S. Development of the modern economy and the history of economic thought to help understand economic problems. The market system as a means of cooperation and as facilitator of individual choice and efficiency in resource use. Inflation, employment, and growth in the national economy and their management by fiscal and monetary policies. Economic theories are presented to clarify policy issues and empirically resolvable controversies. Staff

EB 202 Economics II. Preq: EB 201 or EB 212. 3(3-0) F.S. Analysis of problems of contemporary national and international economics. Topics include the public economy, the financial system, industrial organization, pricing of factors of production, international trade, economic growth and development, and comparative economic systems. Staff

EB 212 Economics of Agriculture. Preq: MA 111. Credit will not be awarded for both EB 201 and EB 212. 3(3-0) F.S. The functioning of the agricultural economy including the allocation of resources in agricultural production, relationships between agriculture and other segments of the economy, and current problems within the agricultural sector. Staff

EB 230 Economics of Cooperatives. 2(2-0) F. Topics include the evolution of cooperative principles and growth of agricultural and consumer cooperative businesses; legislative foundations and legal status of cooperatives; organization, management and financial decisions that are unique to cooperative business enterprises; and a discussion of current public policy issues relating to cooperatives. King

EB 301 Production and Prices. Preqs: MA 113 or 112; EB 201 or 212. 3(3-0) F.S. The functioning of the market economy. The role of prices in determining the allocation of resources, the functioning of the firm in the economy, and forces governing the production of economic goods. Staff

EB 302 Aggregate Economic Analysis: Theory and Policy. Preqs: EB 201 or EB 212 and MA 113 or MA 112. 3(3-0) F.S. Factors determining the national income. Relates the economic behavior of households, business firms and government to the determination of total output, employment, the price level and other aggregate economic variables. Problems of public policy making in achieving full employment and a stable price level. Staff

EB 303 Farm Management. Preq: EB 212 or 201. 3(2-2) F.S. Basic economic principles including the use of budgeting, linear programming, systems analysis and other techniques in determining what, how and how much to produce under various economic conditions. Neuman

EB 307 Business Law I. Preq: EB 201 or 212. 3(3-0) F.S. The main principles of law affecting the conduct of trade as it is affected by contracts, agency and property ownership. Major areas include criminal law, tort law, contract, agency, real and personal property, wills and estates. Staff

EB 308 Business Law II. Preq: EB 307. 3(3-0) F.S. The main principles of law affecting the conduct of trade and industry including real and personal property, mortgages, insurance, wills and estates, sales, business organizations and bankruptcy. Pinna

EB 310 Economics of the Firm. Preq: EB 201 or 212. 3(3-0) F.S. The economic setting within which the business firm makes decisions and an application of economic analysis to these decisions. Economics in managerial decision making. Harrell, Holthausen, Loeb

EB 311 Agricultural Markets. Preq: EB 212 or 201. 3(3-0) S. The agricultural marketing system and the current economic forces affecting its structure and efficiency; decision making by agricultural business firms including integration and interfirm relationships; effects of monopoly in marketing relative to government policies of control. Visits to marketing firms and practical problems illustrating firm decisions. A laboratory period in alternate weeks beginning with the second full week of classes. Students examine individually the marketing problems associated with the commodity of their choice.
Hanson

EB 313 Marketing Methods. Preq: EB 201 or 212. 3(3-0) F.S. The functions of marketing for goods and services in the consumer, industrial and government markets. Emphasis on the role of marketing in our free exchange economic system. Areas studied are the activities of market research, advertising, pricing, channels of distribution, agricultural marketing, international marketing, and the marketing of services. "Consumerism," its causes and its probable future.
Leonard

EB 325 Industrial Management. Preq: EB 201 or 212. 3(3-0) F.S. Principles of management and the management process within the industrial organization. The relation of the financial, marketing, organization, and communication systems to the operations function. Quantitative decision methods for operations planning, organizing, and control. The student manages the operations system of a firm in a simulated environment.
Loeb

EB 326 Personnel Management. Preq: EB 201 or 212. 3(3-0) F.S. The main issues a firm faces in attracting and maintaining a productive work force are examined within an economic framework. Decisions by the profit-maximizing firm in determining wages, fringe benefits and working conditions are analyzed. Other topics include job safety, on-the-job training and the behavior of unions as well as government regulation in the labor market.
Allen, Clark, Wessels.

EB 332 Industrial Relations. Preq: EB 201 or 212. 3(3-0) F.S. The nature and functions of collective bargaining. The objectives and tactics of both labor and management within public policy guidelines. An examination of labor contracts and their implications for labor and management. Emphasis on the impact of change, economic and technological.
Fearn

EB (ST) 350 Economics and Business Statistics. Preqs: MA 113 or MA 112; EB 201 and 202 or equivalent. 3(3-0) F.S. An introduction of statistical application to economics and business problems. Included are such topics as probability, sampling, statistical estimation, inference, index numbers and linear regression.
Wilson, T. Johnson

EB (HI) 370 The Rise of Industrialism. Preq: EB 201 or 212. 3(3-0) F.S. The pattern of historical development of modern industrial economy. Capitalism's origins in 16th century England are related to succeeding developments in the overseas colonial empire and in other areas influenced by those developments.
Sylla

EB (HI) 371 Evolution of the American Economy. Preq: EB 201 or 212. 3(3-0) F.S. Advances of modern industrialization are related to the development of America. Contemporary problems and issues are analyzed with reference to their origins in the historical growth of the economy.
Sylla

EB 401 Economic Analysis for Nonmajors. Preq: EB 201 or 212. 3(3-0) F.S. Intermediate economic theory of firm, household and market behavior primarily for graduate students desiring an economics minor at the master's level. Students with adequate background in economics and mathematics elect EB 501 instead. Topics include demand, production and cost theory, market equilibrium under competitive and non-competitive conditions, an introduction to input-output and general equilibrium theory, the spatial arrangement of economic activity and problems of economic efficiency.
Grennes

EB 404 Money, Financial Markets, and the Economy. Preq: EB 302. 3(3-0) F.S. An in-depth probe of the roles of money, credit, and financial institutions in a market economy. The allocation of credit, the determination of interest rates and security prices, and the activities of the Federal Reserve System are treated.
Dunleavy, Fisher, Lapp

EB 410 Public Finance. Preq: EB 301. 3(3-0) F. A micro economic analysis of the rationale for public expenditure and taxation. Topics include externalities, pollution and public policy, income redistribution and public welfare, public goods, collective choice and political institu-

tions, public budgeting techniques and cost-benefit analysis, taxation and tax policy, state-local finance and fiscal federalism.

Hyman, Knoeber

EB 413 Competition, Monopoly and Public Policy. Preq: EB 301. 3(3-0) S. The effect of modern industrial structure on competitive behavior and performance, considering theories of contemporary price and workable competition. Evaluation of the legislative content, judicial interpretation and economic effects of the anti-trust laws.

Erickson, Flath

EB 415 Farm Appraisal and Finance. Preq: EB 303 or 310. 3(2-2) F. The earnings, market and cost approaches to real estate valuation with practice in the application of current appraisal procedures to rural property. Criteria and techniques for the financial management of a farm. Topics include existing sources and terms of capital, forms of business organization and methods of credit analysis.

Neuman

EB 420 Corporation Finance. Preqs: EB 201 or 212, and ACC 260. 3(3-0) F,S. The principal areas of managerial finance including the techniques necessary to make decisions. Attempts to integrate finance and other functional areas that a corporation must deal with. Relevant macro economics topics. Cases and problems dealing with important topics are analyzed and discussed.

Jones

EB 422 Investments and Portfolio Management. Preqs: EB 201 or EB 212; and 350 or ST 311. 3(3-0) F,S. Analysis of investment process problems including security analysis and emphasizing portfolio management. Brief explanation of traditional thinking and an examination of the modern revolution in investments which emphasizes a quantitative framework to achieve the goal of performance. After describing what an individual investor faces in making decisions, the question of professional management as an alternative is viewed critically.

Jones

EB 430 Agricultural Price Analysis. Preq: EB 301. 3(3-0) F. Principles of price formation; the role of price in the determination of economic activity; the interaction of cash and future prices for agricultural commodities; methods of price analysis, construction of index numbers, analysis of time series data including the estimation of trend and seasonal variations in prices.

Schrimer

EB 431 Labor Economics. Preq: EB 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.

Clark, Fearn

EB 435 Urban Economics. Preq: EB 301. 3(3-0) F,S. 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.

Diamond

EB 436 Environmental Economics. Preq: EB 301. 3(3 0) S. The usefulness 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, Knoeber

EB 442 Evolution of Economic Ideas. Preq: EB 202 or 212. 3(3 0) F. The general development of economic ideas from ancient times through Keynes. Emphasis on the classical school and developments thereafter. Though chronological in presentation, the course will review the evolution of economic ideas in the context of the changes in technology and the increasing complexity of economic activity.

McElroy, Turner

EB 448 International Economics. Preq: EB 301. 3(3-0) F,S. Trade, investment, monetary relations and certain aspects of economic development. Emphasis on analytical and policy approaches with some study of specific international organizations.

Ball, Grennes

EB 451 Introduction to Econometrics. Preqs: EB 301, 302 and 350 or ST 311. 3(3-0) F. The measurement, specification, estimation and interpretation of functional relationships through single equation least-square techniques. Simple and multiple regression, curvilinear regression and various transformations will be used to measure: demand, cost, production, consumption and investment relationships.

Wilson

EB 475 Comparative Economic Systems. Preq: EB 201 or 212. 3(3-0) F.S. Concentration on capitalist or market economies which will be contrasted with collectivist types of systems. Emphasis on the Soviet economy. Turner

EB (TX) 482 Sales Management for Textiles. Preq: TX 380. 3(3-0) S. (See textile technology.)

EB (WPS) 485 Management Development Seminar. Preqs: EB 201 or 212. This course may not be used for credit toward an economics minor for any graduate degree. 3(3-0) S. All the major phases of professional management are covered. Emphasis is placed on developing insight into individual management potential and providing guidance and planning for a management career in industry, government services, or as an entrepreneur. The visiting lecturers, each a management expert, bring insights from their experience. Leonard

EB 490, 491 Senior Seminars in Economics. Preqs: EB 301, 302 and 350 or ST 311 (plus two courses from list of restricted EB electives). 3(3-0) F.S. The terminal EB courses in which undergraduates are assisted in summarizing training, and improving capacity to recognize problems and select logically consistent means of solving problems. This is done on a small group and individual basis. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

EB 501 Price Theory. Preqs: MA 113 and EB 301. 3(3-0) F.S. An intensive analysis of the determination of prices and of market behavior, including demand, cost and production, pricing under competitive conditions and pricing under monopoly and other imperfectly competitive conditions. Graduate Staff

EB 502 Income and Employment Theory. Preqs: MA 113, EB 301 and 302. 3(3-0) F.S. A study of the methods and concepts of national income analysis with particular reference to the role of fiscal and monetary policy in pursuit of full employment without inflation. Graduate Staff

EB (RRA) 503 Economics of Recreation. 3(3-0) F. (See recreation resources administration.)

EB 515 Water Resources Economics. Preq: EB 401 recommended. 3(3-0) F. The application of economic principles to the allocation of water resources. Attention to how to effect maximum economic efficiency in the use of a resource that is no longer a free good, under the consideration of the goals of the public and private sectors of the enterprise economy. Both economic and political consequences of decision making are studied. Seagraves

EB 520 The Theory of Finance. Preq: EB 301 or 401. 3(3-0) F. An analysis of the current state of the related financial areas of portfolio theory, the theory of capital markets, and the theory of firm finance. Emphasis is placed upon the optimum financial choice by both the firm and the individual. Basic topics include decision making under uncertainty, firm investment and financing decisions, portfolio theory and analysis, capital asset pricing models, and the theory of capital market equilibrium. Jones

EB 521 Markets and Trade. Preq: EB 301 or 401. 3(3-0) F. This course emphasizes the space, form and time dimensions of market price and the location and product combination decisions of firms. Consideration is given to the way in which non-price factors and public policy choices influence firm behavior and the efficiency of marketing systems. Application of these models to agricultural, industrial and public service questions is emphasized, including the relationships between resource availability and the spatial arrangement of economic activity. King

EB 523 Planning Farm and Area Adjustments. Preqs: EB 301, 303 or 401. 3(2-2) S. The application of economic principles to production problems on typical farms in the state; methods and techniques of economic analysis of the farm business; application of research findings to production decisions; development of area agricultural programs. Staff

EB 525 Management Policy and Decision Making. Preq: EB 301 or 401. 3(3-0) F.S. Modern management processes used in making top-level policies and decisions. An evaluation of economic, social and institutional pressures, and of the economic and noneconomic motivations, which impinge upon the individual and the organization. The problem of coordinating the objectives and the mechanics of management is examined. Erickson, Flath

EB 532 Economics of Trade Unions. Preq: EB 301 or EB 401. 3(3-0) F. An examination of the growth of the trade union movement in the United States. Primary consideration is given to the impact of unions on the economy through their influence on wages, prices, employment and resource allocation. Other topics include the relationship between the government and unions, the changing compensation mix, and the recent growth in public employee unionism. Clark

EB 533 Agricultural Policy. Preq: EB 301 or 401. 3(3-0) S. A review of the agricultural policy and action programs of the federal government affecting both input supply and commodities. An analysis of objectives, principal means and observable results on resource use and income distribution within agriculture, and between agriculture and the rest of the economy. An appraisal of the effects alternative policy proposals would have on domestic and foreign consumption. Mangum

EB 535 Social Science Concepts in Managerial Processes. Preq: Six hours in economics. 3(3-0) S. Interrelationships between concepts from economics and from other social sciences in managerial processes of clarifying goals, discovering alternatives and choosing courses of action. Cases are used to provide opportunities to compare contributions of theoretical concepts from economics, political science, social psychology, sociology and management science to managerial processes. Theoretical concepts are drawn from readings in the various disciplines. Graduate Staff

EB 540 Economic Development. Preq: EB 301 or 401. 3(3-0) F. An examination of the problems encountered in promoting regional and national economic development. Consideration is given to the structural changes required for raising standards of living. Some basic principles of economics are applied to suggest ways of achieving development goals. Topics include planning strategies, policies and external assistance. Olsen

EB 550 Mathematical Models in Economics Preqs: EB 301, 302, MA 212 and 405 recommended but not required. 3(3-0). An introductory study of economic models emphasizing their formal properties. The theory of individual economic units is presented as a special case in the theory of inductive behavior. Mathematical discussions of the theory of the consumer, the theory of the firm and welfare economics will show the relevance of such topics as constrained maxima and minima, set theory, partially and simply ordered systems, probability theory and game theory to economics. Staff

EB 551 Agricultural Production Economics. Preqs: MA 113 and EB 301 or EB 401. 3(3-0) F. An economic analysis of agricultural production including: production functions, cost functions, programming and decision-making principles. Applications of these principles to farm and regional resources allocation, and to the distribution of income to and within agriculture. Perrin

EB 555 Linear Programming. Preqs: MA 231 or 405 and EB 301 or 401. 3(3-0). Recent developments in the theory of production, allocation and organization. Optimal combination of integrated productive processes within the firm. Applications in the economics of industry and of agriculture. Harrell

EB (ST) 561 Intermediate Econometrics. Preqs: EB 501 and ST 513. 3(3-0) S. The formalization of economic hypotheses into testable relationships and the application of appropriate statistical techniques will be emphasized. Major attention will be given to procedures applicable for single equation stochastic models expressing microeconomic and macroeconomic relationships. Statistical considerations that are relevant in working with time series and cross sectional data in economic investigations will be covered. Survey of simultaneous equation models and the available estimation techniques. P. Johnson

EB 570 Analysis of American Economic History. Preq: EB (HI) 371 or grad. standing. 3(3-0) S. Stresses the application of economic analysis to the formulation and testing of hypotheses concerning economic growth and development in the historical context. Problems selected for analysis will be drawn primarily from American economic history. Sylla

EB (SOC) 574 The Economics of Population. Preq: EB 301 or 401. 3(3-0). A review of population theories from the pre-Malthusian to the contemporary. An introduction to demographic data sources and analysis. Microeconomic models of fertility are intensively

treated, and macroeconomic demographic models also are examined. The public policy implications of these models are developed. Discussions include underpopulation, overpopulation, optimum growth rate and incentive schemes. El-Kammash

EB (TX) 585 Market Research in Textiles. 3(3-0) S. (See textile materials and management.)

EB 590 Special Economics Topics. Preq: Cl. Maximum 6. An examination of current problems on a lecture-discussion basis. Course content will vary as changing conditions require new approaches to deal with emerging problems. Graduate Staff

EB 598 Topical Problems in Economics. Preq: Cl. 1-6. An investigation of topics of particular interest to advanced students under faculty direction on a tutorial basis. Credits and content vary with student needs. Graduate Staff

EDUCATION

ED 100 Introduction to Industrial Education. 2(2-0) F. The framework of vocational education as it relates to the historical and legislative development, programs and purposes in industrial and technical education. Emphasis upon the current status of industrial and technical education in the nation, state and community. Program visitations and observations. Shore

ED 101 Orientation. 0(1-0) F. New freshmen and transfer students (Math Science Education) are required to attend one hour per week during the fall semester. Activities help establish good study habits and adjust to university life. Staff

ED 102 Objectives in Agricultural Education. 1(1-0) F,S. Helps understand the purpose of agricultural education at North Carolina State. Also, develops an understanding of purposes of vocational agriculture and other programs of education in agriculture. Jewell

ED 203 Introduction to Teaching Mathematics and Science. 3(2-3) F,S. For prospective teachers of mathematics/science at the secondary school level. Emphasis on different modes of instruction and instructional strategies. Each prospective teacher designs and teaches a lesson to students in the school at which he is a teacher assistant. Anderson, Simpson, Watson

ED 205 Introduction to Teaching Humanities and Social Sciences. 3(2-3) F,S. For prospective teachers in the school curricular areas of social studies, English, and modern foreign languages. Emphasis on differing aspects and procedures of instruction and an analysis of the competencies required of teachers. Lab, observation and work with children and youth in a variety of educational settings, including an extended period in one curricula area. Staff

ED 220 Introduction to Paraprofessional 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. A study of peer counseling concepts with opportunity for the development of paraprofessional counseling skills. Major consideration is given to developmental issues of young adulthood and crisis intervention. Staff

ED 242 Introduction to Teaching Industrial Arts. Preq: Nine semester hours in industrial arts. 3(2-4) S. To provide in-school experience for sophomore students. This will consist of observation, instructing individual students and small groups or providing aid to the local teachers in laboratory management and maintenance. Lecture and discussion will correlate these activities with teaching theory and practice. Staff

ED 296 Special Topics in Education. 1-3, F,S. Individual or group study of particular areas of education at the Freshman and Sophomore levels. Specific topics will vary from semester to semester. The suffix will indicate the department offering the course: (A) Counselor Education, (B) Occupational Education, (C) Curriculum and Instruction, (D) Mathematics and Science Education.

ED (PHI) 304 Philosophy of Education. 3(3-0) F,S. (See philosophy.)

- ED 305 Analysis of Technical Education Programs and Course Construction.** Preq: ED 100 or equivalent. 3(3-0) S. Selecting and analyzing suitable teaching activities and arranging such material into a functional instructional order. Instructional units prepared will be based on an analysis of a technical occupation or activity. A detailed course of study will be prepared. Shore
- ED 313 Contemporary Vocational Agriculture.** 3(3-0) F,S. The contemporary program is examined in relation to changing and expanding career opportunities in agricultural education. The continuing adjustment of the program objectives, curriculum organization, content of courses, teaching practices, instructional resources and evaluation emphasis in modern programs in vocational agriculture. Prerequisite for student teaching in agricultural education. Miller
- ED (SOC) 318 Introduction to the Sociology of Education.** Preq: Three hours of basic sociology. 3(3-0) F,S. (See sociology.)
- ED 327 History and Philosophy of Industrial and Technical Education.** Preq: ED 100. 3(3-0) F. Place, function and changing concepts of industrial and technical education in America. Economic, sociological and psychological aspects. Parker, Shore
- ED 344 School and Society.** Preq: Jr. or sr. standing. 3(3-0) F,S,Sum. The interrelationship between the school and other institutions, values, and patterns of thought in American society. Beezer, Serow
- ED 362 Curriculum and Methods in Industrial Arts.** Preqs: ED 344, PSY 304. 4(3-2) S. Study of philosophy and objectives for industrial arts education; design and development of curriculum models; comparative teaching methodologies and evaluation. Young
- ED 405 Industrial and Technical Education Shop and Laboratory Planning.** Preqs: Sr. standing, six hours of drawing and design. 3(3 0) F. Principles and techniques of planning and organizing shop and laboratory facilities. Problems of locating and equipping vocational schools; the planning and layout of shops and related technology laboratories and classrooms. Individual and group assignments on planning and layout of post-secondary school buildings. Staff
- ED 411 Student Teaching in Agriculture.** Preq: ED 313, 344, PSY 304; senior standing, admission to teacher education. 8(2-15) F,S. During student teaching, prospective teachers develop skills and techniques involved in teaching vocational agriculture. Each student spends about 9 weeks full-time in a public school. In addition to teaching classes, the student teacher is expected to become familiar with the total program of the school and to participate in as many school activities as possible. Bryant, Miller
- ED 412 Teaching Adults.** Preq: Admission to student teaching semester (ED 102 and 313). 2(2-0) F,S. Principles of effective teaching applied to adults. Experience in organizing and conducting groups for discussion of local problems. Bryant, Miller
- ED 413 Planning Educational Programs.** Preq: Admission to student teaching semester (ED 102 and 313). 2(2 0) F,S. Principles of program planning applied to educational programs in agriculture. Resources needed for adequate planning. Field work in planning programs. Bryant, Miller
- ED 420 Principles of Guidance.** Preq: ED 344. 3(3-0) F,S. An overview of philosophies and principles of guidance services and of the classroom teacher's role in helping the school to realize the goals of developmental guidance programs. Topics include: philosophy, history and models of guidance, principles of counseling, accumulation and use of appraisal and information data, career planning, and placement. Staff
- ED 421 Principles and Practices in Industrial Cooperative Training.** Preq: ED 327, 344, 305. 3(3-0) F. Consideration of the concepts and principles, aims and objectives, developments, operation and evaluation of the industrial cooperative training program in the area of vocational education. Shore, Smith
- ED 422 Methods of Teaching Vocational Industrial/Technical Education.** Preq: ED 327, 305. 3(3-0) F,S. Study of effective methods and techniques of teaching industrial subjects. The course includes competencies needed by successful teachers and how to acquire and use them. Emphasis is given to the preparation of lesson plans, methods and techniques

in the presentation of lessons, use of teaching aids and materials, class organization, shop safety, and evaluation. Smith

ED 423 Methods and Materials in Teaching Modern Foreign Languages. Preq: ED 205, 344, PSY 304; Coreq: ED 424, senior standing, admission to teacher education. 5(4-2) F. A study of the methods of teaching modern languages including the use of instructional media.

Staff

ED 424 Student Teaching in Modern Foreign Languages. Preq: ED 205, 344, PSY 304; Coreq: ED 423, senior standing, admission to teacher education. 8(2-15) F. Provides the prospective teacher of French or Spanish an opportunity to develop and practice the competencies essential for language teaching during 10-week practicum of full-time teaching in a selected off-campus center.

Staff

ED 428 Organization of Related Study Materials in Vocational Education. Preq: ED 327, 344. 3(3-0) S. The principles of selecting, preparing, and organizing related instructional materials for trade preparatory and industrial cooperative training classes.

Shore, Smith

ED 440 Vocational Education. Preqs: ED 444, PSY 304. 2(2 0) F. Comprehensive study of vocational education of less than college grade provided for through federal legislation and an evaluation of program effectiveness. Detailed study of the North Carolina Plan.

Staff

ED 444 Student Teaching in Vocational Industrial/Technical Education. Preqs. ED 344, PSY 304; senior standing, admission to teacher education. 8(2 15) F,S. Provides prospective teachers an opportunity to acquire experience in the techniques and skills involved in teaching vocational industrial/technical education curricula. Students will devote the semester to full-time off-campus teaching in selected schools. In addition to acquiring competencies essential for teaching vocational industrial/technical subjects, the student teacher will have an opportunity to become familiar with the total operation of a school program and with cooperating industries in the community.

Smith

ED 450 Methods and Materials in Teaching English. Preqs: ED 205, 344, PSY 304; senior standing and admission to teacher education with a major in English. 3(3 0) F. A study of the purposes, curricula, materials, and methods of teaching literature and the skills of reading, writing, speaking, and listening in secondary schools, combined with opportunity for application and practice based on this study.

Betts, Walters

ED 451 Improving Reading in Secondary Schools. Preq: Six hours of ED and or PSY. 2(2-0) F,S. 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, Siedow

ED 454 Student Teaching in English. Preqs: ED 205, 344, PSY 304. Senior standing, admission to teacher education, 2.1 overall average, 2.2 in English. 8(2-15) F. Provides the prospective teacher with experience in the techniques and skills involved in teaching English. Each student during the senior year will spend 8 weeks in a selected off-campus center. In addition to acquiring teaching competencies, the student teacher may become familiar with the total school program and may participate in as many school and community activities as time permits.

Betts, Walters

ED 457 Organization and Management of Youth Club Activities. Preq: Jr. standing. 3(3 0) F,S. A study of the history and purposes of organized young adult activities in education. Emphasis upon organization and management of activities to prepare future teachers as competent advisers to the young adult groups in the school setting.

Parker

ED 460 Methods and Materials in Teaching Social Studies. Preqs: ED 205, 344, PSY 304, sr. standing and admission to teacher education with a major in either history, sociology, politics, or economics. 4(3-1) F. A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of social studies at the secondary level.

Harper

ED 464 Student Teaching in Social Studies. Preqs: ED 205, 344, PSY 304; senior standing, admission to teacher education; Coreq: ED 460. 8(2-15) F. This course provides the prospective teacher an opportunity to acquire practical experience in using skills and techni

ques in teaching social studies in secondary schools. Each student during the senior year will spend eight weeks in a selected off campus center. The student will demonstrate competencies essential for teaching social studies, become familiar with the total school program and participate in as many school and community activities as time will permit. Harper

ED 470 Methods of Teaching Mathematics. Preq: Admission to teacher education. 3(3-0) F,S. A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of mathematics at the secondary level.

Kolb, Speece, Waters, Watson

ED 471 Student Teaching in Mathematics. Preqs: ED 203, 344, PSY 304, sr. standing, admission to teacher education; Coreq: ED 470, 472. 8(2-15) F,S. Provides the prospective teacher with an opportunity to get experience in the skills and the techniques involved in teaching mathematics. Each student during the senior year will spend 10 weeks off-campus in a selected center. In addition to acquiring teaching competencies, the student teachers may become familiar with the total school program and may participate in as many community activities as time permits.

Kolb, Speece, Waters, Watson

ED 472 Developing and Selecting Teaching Materials in Mathematics. Preq: Admission to teacher education. Coreq: ED 470, 471. 2(0-6) F,S. Developing and selecting teaching material to effect new and changing concepts of the content and emphasis in high school mathematics. Course follows the class discussion and demonstration pattern. Study of latest instructional materials and devising materials and aids for increasing the effectiveness of the content and instruction.

Kolb, Speece, Waters, Watson

ED 473 Student Teaching in Industrial Arts. Preq: Admission to teacher education. 8(2-15) F. Students in industrial arts will devote eight weeks during the fall semester to full-time, off-campus student teaching in selected public schools throughout the state. They will be assigned to their teaching center in the preceding spring and will report to their supervising teachers when the public schools (to which they are assigned) open in the fall. During the remainder of the term, additional courses will be taken in concentrated form.

Wenig

ED 475 Methods of Teaching Science. Preq: ED 203, 344, PSY 304. 3(3-0) F. A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of physical and biological science at the secondary school level. This course will serve as preparation for student teaching in science.

Anderson, Simpson

ED 476 Student Teaching in Science. Preqs: ED 203, 344, PSY 304; Coreq: Sr. standing and admission to teacher education, ED 475, 477. 8(2-15) F. Provides prospective teachers with an opportunity to get experience in the skills and techniques involved in teaching science. Each student during the senior year will spend 10 weeks off-campus in a selected center. In addition to acquiring competencies for teaching science, the student teacher may become familiar with the total program and may participate in as many community activities as time permits.

Anderson, Simpson

ED 477 Instructional Materials in Science. Preqs: ED 203, 344, PSY 304; Coreq: ED 475, 476, sr. standing and admission to teacher education. 2(1-3) F. Developing and selecting teaching materials in keeping with the new and changing concepts of the content and emphasis in high school science, particularly the experimental and laboratory approach. Students study the latest instructional materials and discover or devise materials and aids for increasing the effectiveness of the content and instruction.

Anderson, Simpson

ED 479 Industrial Arts Laboratory Planning. Preq: Junior standing in industrial arts education. 3(1-4) F. Industrial arts laboratory planning for efficient and safe operations, management of materials and supplies, budgeting, inventory, maintenance of common tools and equipment, safety equipment, and regulations and practices pertaining to laboratory operations are considered.

Young

ED 483 An Introduction to Instructional Media. Preq: Advanced undergrad. standing. 3(3-0) F,S,Sum. The characteristics and utilization of media for instruction; study and implementation of the relationship between media and instructional objectives; and elementary projects in designing, developing, and using instructional media materials.

Staff

ED 490 Senior Seminar in Agricultural Education. For Agricultural Education majors only; maximum of three credits can be obtained. 1(1-0) F,S. Analysis of opportunities and

problems facing educational leaders in agriculture with emphasis upon current problems.
Jewell, Miller

ED 495 Senior Seminar in Mathematics and Science Education. 1-3 F,S. An in-depth investigation of a teaching area in mathematics and/or science education by above-average department majors following their student teaching.
Staff

ED 496 Senior Seminar in Education. Preq: Cl. 1-3 F,S,Sum. An in-depth investigation and discussion of a topic or set of problems in professional education.
Staff

Selected 500-Level Courses Open To Advanced Undergraduates

ED 500 The Community College System. Preq: Grad. or advanced undergrad. standing. 3(3-0) F,S. Comprehensive community colleges and technical institutes and the state systems of which they are a part: underlying concepts, educational needs they are designed to serve, role in meeting these needs, historical development, issues in the establishment and operation of state systems and individual institutions, unresolved issues and emerging trends.
Graduate Staff

ED (SOC) 501 Leadership. Preq: SOC 202 or equivalent. 3(3-0) F,S. A study of leadership in various fields of American life; analysis of the various factors associated with leadership; techniques of leadership. Particular attention is given to recreational, scientific and executive leadership procedures.
Graduate Staff

ED 503 The Programming Process in Adult and Community College Education. Preqs: ED 501, Cl. 3(3-0) F,S. The principles and processes involved in programming, including basic theories and concepts supporting the programming process. Attention will be given to the general framework in which programming is done, the organization needed and the program roles of both professional and lay leaders.
Graduate Staff

ED 504 Principles and Practices of Introduction to Vocations. Preq: Twelve hours in ED. 3(3-0) F,S. This course is designed for teachers in the public schools of North Carolina who teach "Introduction to Vocations." The course emphasizes the place of the introduction to vocations program in the overall school curriculum, special methods of instruction, use of teaching aids and use of student evaluation instruments. An overview is also presented in the areas of community organization, job markets, group procedures, occupational and educational information, and the changing occupational structure in our society.
Cox

ED 506 Education of Exceptional Children. Preq: Six hours ED or PSY. 3(3 0) F,S,Sum. Principles and techniques of teaching the exceptional child with major interest on the mentally handicapped and slow learner. Practice in instruction for groups of children, and individual techniques for teaching retarded children in average classroom. Opportunity for individual work with an exceptional child.
Graduate Staff

ED 508 Severe and Profound Mental Retardation. Preq: ED 531 or Cl; Coreq: ED 508 may be taken concurrently with ED 531. 3(3-0) F. A study of the area of severe and/or profound mental retardation, including definitions, incidence, etiology, characteristics, assessment procedures, educational programs and social/vocational programs. Course will also focus on the legal and ethical issues involved in working with the severely retarded.
Hasselbring

ED 509 Methods and Materials—Teaching Retarded Children. Preq: ED 506. 3(3-0) S. Understanding and correlating developmental levels of mentally retarded children and appropriate educational methods and materials. Use of child's diagnostic data; consideration of long and short range educational goals; curriculum planning and scheduling; teacher guidance of children toward social and emotional maturity.
Hasselbring

ED 511 Implications of Mathematical Content, Structure, and Processes for the Teaching of Mathematics in the Elementary School. Preq: Bachelor's degree in elementary education or Cl. 3(3-0) F. Designed for teachers and supervisors of mathematics in the elementary school. Special emphasis on implications of mathematical content, structure, and processes in teaching arithmetic and geometry in elementary school.
Watson

ED 512 Teaching Mathematics in Elementary and Junior High School. Preq: ED 471 or equivalent. 3(3-0) S,Sum. Comprehensive study of teaching mathematics in elementary and

junior high schools. Major emphasis on building skills in teaching arithmetic, elementary algebra and intuitive geometry. Thorough search of the literature relative to the mathematics curricula will be conducted, designing and sequencing of learning activities, teaching mathematical concepts and relationships, building skill in computation, reading mathematics, problem solving, and measurement will be covered. Watson

ED (SOC) 513 Community Organization. Preq: SOC 202 or equivalent. 3(3-0) F. Community organization is viewed as a process of bringing about desirable changes in community life. Community needs and resources available to meet these needs are studied. Democratic processes in community action and principles of community organization are stressed, along with techniques and procedures. The roles of leaders, both lay and professional, in community development are analyzed. Graduate Staff

ED 514 Formative Ideas in American Education. Preq: Six hours ED or PSY, or CI. 3(3-0) F,Sum. A consideration of the theory and practice of American education as an extension of the philosophical climate of opinion of different intellectual ages, and how the present status of our educational system is grounded in the thought of the past. Beezer

ED 515 Teaching Disadvantaged Youth. Preqs: Six hours ED or PSY, teaching experience. 3(3 0) Alt. S,Sum. This course presents a theoretical structure for looking at and understanding the problems disadvantaged youth face in our educational system. It offers a set of alternative teaching strategies for helping children learn. Graduate Staff

ED 516 Community Occupational Surveys. Preqs: Six hours in ED, CI. 2(2-0) S. Methods in organizing and conducting local surveys and evaluation of findings in planning a program of occupational education. Shore, Hanson

ED 519 Early Childhood Education. Preq: PSY 475 or PSY 576. 3(1-4) Alt. yrs. Planning, selecting, and using human resources, activities, materials, and facilities in the education of young children. Student observation, participation and evaluation of educational experiences for the developmental level of individual children for an optimum learning environment. A synthesis of the student's knowledge of human development, learning theory and research findings as related to classroom application. Graduate Staff

ED 520 Introduction to Guidance and Counseling. Preq: Six hours in ED or PSY. 3(3-0) F,S,Sum. An introduction to the philosophies, theories, principles and issues of guidance and counseling services, with major emphasis on guidance at the secondary school level. Graduate Staff

ED 521 Internship in Guidance and Personnel Services. Preqs: Eighteen hours in department and CI. Credits Arranged. F,S. A continuous full-time internship of at least one-half semester. Framework of school and community. Work with students, teachers, administrators, guidance and pupil personnel workers, parents, and resource personnel in the community. Supervision of intern by guidance personnel in school as well as by course instructors. Graduate Staff

ED 522 Career Exploration. Preq: ED 344 and grad. status or CI. 3(3-0) F,S. This course is designed for teachers in the public schools of North Carolina who teach in "career exploration" programs. The course emphasizes the philosophy of career exploration, theories supporting career exploration, the place of exploration programs in the overall school curriculum, correlation of occupational information in academic subjects, sources of occupational information and its use, and approaches to teaching in a career exploration program. Cox

ED 523 Orientation and Mobility of the Visually Impaired. 3(3-0) Sum. The sensory processes and sensory cues on which independent mobility depends for the visually impaired person. Various techniques and modes of travel considered. Emphasis given to instruction and background which will enable person not teaching orientation mobility as a skill to reinforce the learning that takes place in other situations. Graduate Staff

ED 524 Information Processes and Group Guidance Preq: Six hours of ED or PSY. 3(3-0) F,S,Sum. The collection, classification, and use of occupational, educational, and personal social information in schools, post-secondary institutions and agencies. The course is also designed to help teachers and counselors learn about group guidance activities and to learn

how to plan and organize the information service as well as specific guidance activities in groups. Gerler

ED 526 Teaching in College. 3(3-0) F,S,Sum. Designed primarily for graduate students in the departments outside the School of Education, this course focuses on the development of competencies to perform the fundamental roles of a college teacher as well as consideration of more long-range tasks such as course development and the university responsibilities of a professor. In addition to attending lectures and other types of presentations, students will make video tapes of their teaching, develop tests, design an introductory course in their teaching field, and discuss current issues that relate to university and college teaching. Simpson

ED 528 Cooperative Occupational Education. Preq: CI. 3(3-0) F,S. Designed for individuals preparing to be directors, administrators or supervisors of occupational education programs at the local, state and/or national levels. Emphasis on organization and operation of cooperative occupational education programs. Covers the entire field of cooperative occupational education on secondary, postsecondary and adult levels with references to accepted essentials of cooperative education so details of planning, organization, establishment, and operation of cooperative occupational programs will be practical and meaningful. Student visitations to existing quality programs in cooperative occupational education to study on-site conditions in specialized areas. Smith

ED 529 Curriculum Materials Development. Preq: ED 525. 3(3-0) F,S. Selection and organization of curricula and instructional materials. Hanson

ED 530 Theories and Techniques of Counseling. Preq: Six hours of ED or PSY; Coreq: ED 520 or equivalent. 3(3-0) F,S,Sum. A combination of the study of theory and philosophy in counseling with techniques of counseling. Topics to be examined include behavioral approaches, psychoanalytic approaches, client-centered counseling, existential counseling and relationship models, and their relation to counseling. For each theory, the techniques are related to the theoretical concepts and principles. Graduate Staff

ED (PSY) 531 Mental Retardation. Preqs: Nine hours PSY and special education. 3(3-0) F,Sum. Description, causation, psychological factors and sociological aspects of mental retardation. Examination of educational methods for the mentally retarded. Hasselbring

ED 533 Group Counseling. Preq: ED 530. 3(3-0) S,Sum. A study of the theory and principles of effective group work and the skills necessary for using specific counseling techniques, for the planning and organization of group counseling activities in the elementary school, secondary school, or other institutions. Supervised experience provides, to a limited extent, practice in the use of various techniques of group leadership in the area of interest for each student. Locke

ED 534 Guidance in the Elementary School. Preq: Nine hours PSY or CI. 3(3-0) F,S,Sum. Designed for acquainting elementary school teachers, counselors and administrators with theory, practice and organization of elementary school guidance. Gerler

ED 535 Student Personnel Work in Higher Education. Preqs: Nine hours PSY or CI. 3(3-0) F,S. Examines practices in various areas of student personnel work. Studies both structure and function of student personnel programs in higher education. McVay

ED 536 Structure and Function of the Eye and Use of Low Vision. Preq: CI. 3(3-0) Sum. Special institute for participants to spend minimum of 45 hours in class and class related activities. Medical and educational consultants discuss structure and function of the eye, eye anomalies affecting children with low vision, methods of teaching children to use minimal vision effectively. Graduate Staff

ED 539 Educational Gerontology. Preq: Six hours in ED, SOC, or PSY. 3(3-0) F. A broad overview of factors associated with the education of older adults. Various sociological, physiological, psychological, and economic aspects of aging are explored in terms of their educational implications. Attention is given to knowledge and skills required for the development of educational programs for the aging population. Graduate Staff

ED 541 Community Education. Preq: ED 503 and SOC 513. 3(3-0) S. This course explores nonformal approaches to education in community settings. History and philosophy of com

munity education, models of institutional response to community, functional dimensions of community education, and community education planning are analysed within the context of matching resources to needs. Students will develop knowledge and skill in the designing of community education as a process and a product. Graduate Staff

ED 542 Contemporary Approaches in the Teaching of Social Studies. Preq: Advanced undergrad. or grad. standing; must have completed student teaching. 3(3-0) S,Sum. An analysis of the principles, strategies and application of new teaching approaches. Study of team-teaching, programmed instruction, inductive and reflective-oriented teaching; role-playing, simulation and gaming, independent study and block-time organization. Harper, Parramore

ED 543 Adulthood and Learning: The Later Years. Preq: ED 539 or CI. 3(3-0) Alt. S. A study of basic sensory, attitudinal, intellectual, and emotional changes that occur in individuals during the process of growing old and the implications of these changes for developing, implementing, and evaluating educational programs for and with older adults. Glass, Trent

ED 545 Developmental Reading Instruction. Preq: Twelve hours of ED or PSY. 3(3-0) F. A study of current methods and materials for the teaching of developmental and remedial reading, with emphasis on planning and implementing instructional programs for children with reading competencies from prereading through grade six. Graduate Staff

ED 546 Principles and Practices of Secondary School Reading Instruction. Preq: Twelve hours in ED or PSY. 3(3-0) F,Sum. A study of principles and practices of teaching reading at the secondary school level, including reading instruction in the content areas. Siedow

ED 547 Analysis of Reading Abilities. Preq: ED 545 or ED 546. 3(3-0) S. A study of tests and techniques in determining specific abilities; a study of reading retardation and factors underlying reading difficulties. Fox

ED 548 Theory and Process in Reading and Language Arts. Preq: Twelve hours in ED or PSY. 3(3-0) Alt. yrs. An investigation of theoretical models and processes in reading and language arts with emphasis on the translation of research findings to instructional practice. Fox

ED 555 Comparative Crafts and Industries. Preqs: Advanced undergrad. or grad. standing. CI. 6 Sum. A travel seminar as a cultural appreciation course involving study of indigenous crafts and industries, their materials, processes, products and design in foreign countries. Graduate Staff

ED 556 Learning Disabilities. Preq: ED 506 or CI. 3(3-0) F. A study of the field of learning disabilities, including definitions, prevalence, etiology, characteristics and current educational trends for educating learning disabled students. Crossland

ED 557 Methods and Materials in Learning Disabilities. Preq: ED 556 or CI. 3(3-0) S. A study of the current methods and materials for the teaching of learning disabled students in the elementary and/or secondary schools, including curriculum and instructional techniques. Course will focus on examination of commercial materials and the development of teacher-made materials for use with the learning disabled student. Crossland

ED 558 Resource Teaching in Special Education. Preq: ED 506 or CI. 3(3-0) S. A study of resource teaching in the area of special education, with emphasis on resource teaching with the learning disabled and mentally retarded. Course will focus on types of resource programs, how to establish and maintain a program, selection of students, curriculum and materials. Graduate Staff

ED 559 Learning Concepts and Theories Applied to Adult and Community College Education. Preq: Six hours in ED. 3(3-0) S. Principles involved in adult education programs including theories and concepts undergirding and requisite to these programs. Emphasis will be given to the interrelationship of the nature of adult learning, the nature of the subject matter and the setting in which learning occurs. The applicability of relevant principles and pertinent research findings to adult learning will be thoroughly treated. Graduate Staff

- ED (IA) 560 New Developments in Industrial Arts Education.** 3(3-0) F,S,Sum. (See in dustrial arts education.)
- ED 561 Educational Diagnosis and Prescription for Exceptional Children.** Preq: ED 506 or CI 3(3-0) F. A study of the concept of educational diagnosis of exceptional students, including an examination of educational diagnostic procedures in current use in special education. Course will focus on the development of informal diagnostic techniques and procedures for adapting curriculum and instruction for the exceptional learner. Graduate Staff
- ED 562 Communication Disorders in the Classroom.** Preq: ED 506 or CI 3(3-0) S. Alt. yrs. A study of communication disorders which occur in the school age population, including types of disorders, prevalence, etiology, characteristics, and corrective therapy. Course will focus on communication disorders among exceptional students and the classroom teacher's role in working with communication disorders. Crossland
- ED 563 Effective Teaching.** Preq: Twelve hours ED including student teaching, 3(3-0) F,S,Sum. Analysis of the teaching-learning process; assumptions that underlie course approaches; identifying problems of importance; problem solution for effective learning; evaluation of teaching and learning; making specific plans for effective teaching. Graduate Staff
- ED 564 Classroom Management in Special Education.** Preq: ED 506 or CI 3(3-0) F. A study of the concepts and procedures involved in the design and implementation of techniques for managing exceptional students in a classroom setting. Course will focus on methods for increasing and maintaining appropriate classroom behaviors in exceptional learners. Graduate Staff
- ED 570 Foundations of Mathematics Education.** Preq: ED 471 or equivalent, 3(3-0) Sum. A course on the current status of mathematics education with special emphasis on the critical study of current practices in mathematics instruction from elementary school through college. Kolb, Waters, Watson
- ED 575 Foundations of Science Education.** Preq: ED 475 or equivalent, 3(3-0) S,Sum. Philosophical, historical, sociological, political, and economic factors affecting science education in the schools of the United States will be analyzed. The implications of various learning theories for science education will be examined along with models for curriculum development and program planning. Current trends, issues, and problems in science education will be evaluated in terms of multiple positions. Anderson, Simpson
- ED 577 Improving Classroom Instruction in Science.** Preq: ED 475 or equivalent, 3(3-0) S,Sum. Application of major principles of education and psychology to the improvement of science teaching in elementary and secondary schools. Identification and definition of classroom problems, clarification of goals and objectives, selection of instructional strategies, development or selection of science materials, evaluation of achievement in science, and establishing a desirable classroom climate. Anderson, Simpson
- ED 590 Special Problems in Guidance.** Preqs: Six hours grad. work in department or equivalent and CI. Maximum 6 F.S. Intended for individual or group studies of one or more of the major problems in guidance and personnel work. Problems will be selected to meet the interests of individuals. The workshop procedure will be used whereby special projects, reports, and research will be developed by individuals and by groups. Graduate Staff
- ED 591 Special Problems in Industrial Education.** Preqs: Six hours graduate credit, permission of program coordinator. Maximum 6 F.S. Directed study to provide individualized study and analysis in specialized areas of trade, industrial, or technical subjects. Graduate Staff
- ED 592 Special Problems in Mathematics Teaching.** Preq: ED 471 or equivalent, 1-3 Sum. An in-depth investigation of topical problems in mathematics teaching chosen from the areas of curriculum, methodology, facilities, supervision and research. Graduate Staff
- ED 593 Special Problems in Agricultural Education.** Preq: ED 411 or equivalent. Credits Arranged. F.S. Opportunities for students to study current problems under the guidance of the staff. Graduate Staff

ED 594 Special Problems in Science Teaching. Preq: ED 476 or equivalent. 1-3 Sum. An investigation of current problems in science teaching with emphasis on areas in curriculum, methodology, facilities, supervision and research. Specific problems studied in depth. Opportunities will be provided to initiate research studies. Graduate Staff

ELECTRICAL ENGINEERING

EE 201 Electric Circuits I. Preqs: PY 205, MA 201; Coreq: PY 208, MA 202. 4(3-3) F,S. Introduction to analysis of electric circuits. Circuit elements and parameters, resistance, capacitance, inductance, impedance, admittance, charge, current, voltage, energy, power. Kirchhoff's voltage and current laws. Superposition, periodic functions, RMS values, phasors, resonance, Q, bandwidth.

EE 202 Electric Circuits II. Preq: A grade of C or better in EE 201. 4(3-3) F,S. Continuation of EE 201. Analysis of electric circuits by consideration of equivalent circuits which arise in the study of solid state electronics, digital circuits, and AC systems. Transistor equivalent circuits, amplifier frequency response, operational amplifiers, logic gates. Magnetic circuits, transformers, polyphase circuits.

EE 211 Electric Circuits I, Theory. Preqs: MA 201 and PY 205. 3(3-0). Theory part of EE 201. Enrollment subject to approval of EE undergraduate administrator.

EE 213 Electric Circuits I, Laboratory. Preq: EE 211. 1(0-2) Sum. Laboratory part of EE 201. Enrollment subject to approval of EE undergraduate administrator and limited to students who have passed EE 211.

EE 301 Linear Systems. Preqs: A grade of C or better in EE 202. 3(2-2). F,S. Introduction to representation and analysis of linear systems. Topics covered include impulse response and convolution, Fourier analysis, and Laplace transforms. The techniques are illustrated by applications from communications and control systems analysis.

EE 302 Numerical Applications in Electrical Engineering. Preq: A grade of C or better in EE 202. 3(2-2) F. This course introduces the student to modern problem solving techniques in electrical engineering using the computer. The course consists of a series of analysis and design problem examples in electrical engineering.

EE 303 Electromagnetic Fields. Preqs: MA 301 and a grade of C or better in EE 202. 4(3-2.5) F,S. Limitations of lumped constant circuit models and the necessity for distributed parameter models. Electromagnetic wave propagation on transmission lines, in waveguides and in unbounded space. Introduction to antennas and propagation.

EE 305 Electric Power Systems. Preq: A grade of C or better in either EE 202 or EE 331. 4(3-2.5) S. Principles performance and characteristics of direct-current and alternating current machinery. Consideration of the components, protective devices and power flow of a typical power distribution system for an industrial plant. Application of digital computers to fault calculations.

EE 314 Electronic Circuits. Preq: A grade of C or better in EE 202. 4(2-5) F,S. Electronic design fundamentals, including circuit properties of active devices, linear and digital integrated circuits, power and industrial electronics. Emphasis is on the terminal characteristics and circuit applications of integrated circuits and solid-state devices.

EE 331 Principles of Electrical Engineering. Preqs: MA 201, PY 208. 3(3-0) F,S. Not available to EE undergraduates. Basic concepts, units and methods of EE analysis. Current-voltage characteristics of linear and nonlinear electrical devices, analysis of d-c and a-c circuits, simple amplifiers and energy conversion devices. Demonstrations of equipment and procedures.

EE 332 Principles of Electrical Engineering. Preq: EE 331. 3(3-0) S. Not available to EE undergraduates. Power distribution systems, motors, feedback, amplifiers, oscilloscopes, voltage meters, digital information, measurement by digital means, presented from the user's viewpoint. Demonstrations of equipment and procedures.

- EE 333 Principles of Electrical Engineering Laboratory.** Coreq: EE 332. 1(0-3) S. Not open to EE students. Laboratory work in the material covered in EE 332.
- EE 339 Principles of Electrical Engineering Laboratory.** Coreq: EE 331. 1(0 3) F,S. Not open to EE students. Laboratory work in the material covered in EE 331.
- EE 340 Fundamentals of Digital Systems.** Preq: A grade of C or better in EE 202; Coreq: EE 302. 4(3-3) F,S. The basic concepts involved in the design of digital electronic networks. Topics include discussion of available packages and parameters, specification and design of combinational and sequential networks, digital subsystems, and system organization.
- EE 350 Introduction to Industrial Power Systems.** Preqs: MA 201, PY 212. Not available to EE majors. 3(2-3) S,Sum. Introductory course in electrical engineering emphasizing the principles of electric power distribution and utilization in industrial installations. Basic electrical theory and measurements, d-c and a-c circuits, single-phase and polyphase systems, magnetic forces and fields, transformers, a-c motors and elementary principles of system layout and control.
- EE 431 Electronics Engineering.** Preq: EE 314. 3(2-3) F. Design and analysis of discrete and integrated solid-state electronic circuits which include amplifiers, waveform generators, and feedback. Design is emphasized through projects and through analysis of contemporary electronic circuits.
- EE 432 Communication Engineering.** Preq: EE 431 3(2-3) S. Application of electronic circuits to communication systems employing sine wave and pulse modulation. Elements of complete systems (modulators, demodulators, transmitters and receivers) are designed, analyzed and implemented.
- EE 433 Electric Power Engineering.** Preq: EE 305 or 332. 3(2 3) S. Electric power supply for industrial and commercial applications. Control of electric motor drives. Principles of circuit protection and safety. Laboratory experience in testing electric machines.
- EE 434 Power System Analysis.** Preq: EE 305. 3(3-0) F. Problems encountered in the long-distance transmission of electric power with emphasis on load flow, economic dispatch, and fault calculations. Applications of digital computers to power-system problems.
- EE 435 Elements of Control.** Preqs: EE 314, 305. 3(2 3) F. Introductory theory of open and closed-loop control. Dynamic analysis of error detectors, amplifiers, and motors. Component transfer characteristics and block diagram representation. Analog simulation of a control system.
- EE 441 Introduction to Electron Devices.** Preqs: MA 301, PY 208. 3(3-0) F. The basic physical principles necessary for understanding modern electronic devices. Quantum and statistical mechanic concepts are introduced forming the basis for a discussion of a wide variety of devices used in modern engineering and instrumentation.
- EE 443 Digital Systems Design.** Preq: EE 340. 3(2-3) F. The practice of solving electronic engineering problems using digital techniques. Includes the application of the concepts of problem specification, organization, and design. Introduction to current technology and state-of-the-art components. Experience in utilizing this background in the design, implementation and testing of a class project.
- EE 448 Microwave Antennas, Radars and Communication Systems.** Preq: EE 303. 3(3-0) S. The principles of microwave antennas and components as they are used in modern radar and communication systems. Fraunhofer diffraction, phased arrays, the radar and Friis propagation equations, antenna temperature, propagation effects and sources of system noise are discussed and applied to modern system design.
- EE 492 Special Topics in Electrical Engineering.** Preq: CI. 1-4 F,S. Offered as needed for the development of new courses in Electrical Engineering. Work may be done in any area of Electrical Engineering such as computers, communications, power, microwaves, or electronics. Methods of study could be reading in the literature, design projects, or lectures.

Selected 500-Level Courses Open To Advanced Undergraduates

- EE 503 Computer-Aided Circuit Analysis.** Preqs: EE 314, 301, B average in EE and MA. 3(3-0) F. Analysis of electrical circuits with emphasis on computer methods. Steady-state

and transient analysis of linear and nonlinear networks; tolerance analysis; programming considerations. Graduate Staff

EE 504 Introduction to Network Synthesis. Preqs: EE 301, B average in EE and MA. 3(3-0) S. A study of the properties of network functions and the development of the methods of network synthesis of one port and two-port passive structures. Introduction to active RC filters. Graduate Staff

EE 511 Electronic Circuits. Preqs: EE 314, B average in EE and MA. 3(3-0) S. A study of circuit and system applications of analog devices and integrated circuits. Performance characteristics and limitations of a wide variety of analog electronic devices and circuits will be considered. Selected laboratory projects are used to provide direct experience in advanced analog electronics. Graduate Staff

EE 512 Communication Theory. Preqs: EE 301, B average in EE and MA. 3(3-0) F. Communication signals in the frequency and time domains. Probability and associated functions, random signal theory, modulation and frequency translation, noise, sampling theory, correlation functions, and information theory. Accent on methods and problems unique to the field of digital communication. (Offered F every year, Sum. 1980 and S 1980.) Graduate Staff

EE 516 Feedback Control Systems. Preqs: EE 435 or EE 301, B average in EM and MA. 3(3-0) S. Introduction to analysis and design of continuous and discrete-time dynamical control systems. Emphasis on linear, single-input-single-output systems using state variable and transfer function methods. Topics include open and closed-loop representation; analog and digital simulation; time and frequency response; stability by Routh-Hurwitz, Nyquist, and Liapunov methods; performance specifications; cascade and state variable compensation. Assignments utilize computer-aided analysis and design programs. Graduate Staff

EE 517 Control Laboratory. Coreq: EE 516. 1(0 3) F,S. Study of dynamical system models and multivariable control applications based on scheduled experiments and independent projects selected to contribute to a better understanding of the topics treated in EE 516, E (OR) 531, EE 613, 614, and E (OR) 650. Graduate Staff

EE 520 Fundamentals of Logic Systems. Preqs: EE 340, B average in EE and MA. 3(3-0) F. A study of algebraic structures as related to logic systems, models for switching circuit behavior and their relation to hardware implementation. Includes theoretical treatment of both combinational and sequential logic systems concepts. Graduate Staff

EE 521 Digital Computer Technology and Design. Preq: EE 520. 3(3-0) S. A study of the internal structure and organization of digital systems with the computer as a primary focus. The emphasis is on problem description and modeling as required in the design process. The design of all major components in digital systems, including memory, input-output, and control utilizing current technology, will be discussed. Graduate Staff

EE 530 Physical Electronics. Preqs: EE 304, B average in EE and MA. 3(3-0) F. A study of the properties of charged particles under the influence of fields and in solid materials. Quantum mechanics, particle statistics, semi-conductor properties, fundamental particle transport properties and lasers. (Offered F every year, Sum. 1981 and S 1979.) Graduate Staff

EE 533 Integrated Circuits. Preqs: EE 314, B average in EE and MA. 3(3-0) S. A study of the implementation of solid state circuits in integrated form. Includes bipolar and MOS technologies and their application with emphasis on digital systems. Snyder

EE 540 Electromagnetic Fields and Waves. Preqs: EE 304, B average in EE and MA. 3(3-0) F. Basic laws and concepts of static and dynamic electromagnetic fields. Fundamental equations and their applications. Fundamentals, forms and applications of Maxwell's equations. Vector and scalar potentials, relativistic aspects of fields, energy and power. Waves in unbounded and bounded regions, radiation, waveguides and resonators. Geometrical and physical optics. (Offered F every year, S 1981 and Sum. 1979.) Graduate Staff

EE 545 Introduction to Radio Wave Propagation. Preqs: EE 304, B average in EE and MA. 3(3-0) S. Characteristics of plane electromagnetic waves in homogeneous and non-homogeneous media with application to tropospheric and ionospheric propagation.

Relationships between electron density, collision frequency and complex refractive index, theory of the formation and dynamics of ionospheric layers and theorems for the prediction of ionospheric propagation. Flood

EE (PY) 552 Introduction to the Structure of Solids. 3(3-0) S. (See physics.)

EE (MAE) 565 Gas Lasers. 3(3-0) F,S. (See mechanical and aerospace engineering.)

EE 591, 592 Special Topics in Electrical Engineering. Preq: B average in technical subjects. 3(3-0) F,S. A two-semester sequence to develop new courses and to allow qualified students to explore areas of special interest. Graduate Staff

EE 593 Individual Topics in Electrical Engineering. Preq: B average in technical subjects. 1-3 F,S. A course providing an opportunity for individual students to explore topics of special interest under the direction of a member of the faculty. Graduate Staff

ENGINEERING HONORS

EH 346 Fluid Mechanics. Preq: CE 243 or MAE 206, membership in the Engineering Honors Program. 3(3-0) S. Equilibrium of liquids and gases, kinematics and dynamics of frictionless fluids. Motion of viscous fluids. Dynamics of gases. Flow measurement techniques.

EH 371 Thermodynamics I. Preq: Membership in the Engineering Honors Program. 3(3-0) F. Basic principles and concepts. Emphasis on first and second laws, their implications and applications. Properties of actual and real gases. Also inter-relationships between the properties as given by the general equations of thermodynamics.

EH 372 Thermodynamics II. Preq: Membership in the Engineering Honors program. 3(3-0) S. Statistical approach to thermodynamics and application to determination of specific heats. Entropy and probability. Thermodynamics of fluid flow including supersonic flow. Basic laws of heat transfer. Ideal gas and vapor cycles. Introduction to chemical thermodynamics.

EH 391 Contemporary Trends in Engineering. Preq: Membership in the Engineering Honors program. 1(1-0) F. Seminars on current topics in technology, led by professionals from the several branches of engineering.

EH 491 Engineering Honors Seminar. Preq: Membership in the Engineering Honors program. 1(1-0) S. A forum for the presentation by students of their honors projects, with discussion.

EH 496 Special Topics in Engineering. Preq: Membership in the Engineering Honors program. 1-4 F,S. Individual projects of a research or design nature.

ENGLISH

FRESHMAN ENGLISH

ENG 110 Developmental English. Credit is not applicable toward graduation in any curriculum. 3(3 1) F,S. A study of the fundamentals of English for the purpose of developing the basic skills of writing, conducted by means of supervised writing exercises and self-paced drills. Includes parts of speech; principles of spelling, capitalization, and punctuation; vocabulary study; and composition of sentences and simple paragraphs. Staff

ENG 111 Composition and Rhetoric. Successful completion of ENG 111 requires a grade of C or better. 3(3 0) F,S. Basic forms and principles of expository communication; conferences. Staff

ENG 112 Composition and Reading. Preq: A grade of C or better in Eng 111. 3(3-0) F,S. Expository writing; introduction to literary types; collateral reading; conferences. Staff

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, plus a composition to be written at the first or second class meeting of the ENG 112H section.

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 200 Composition Laboratory. 0(0-2) F.S. A noncredit course in composition designed for upperclassmen in any curriculum who are deficient in spelling, mechanics, sentence structure, and general organization. Not a substitute for courses in advanced composition. Staff

ENG 214 Copyediting. 3(3-0) F.S. Basic writing and editorial skills needed to work effectively with material produced by others. Emphasis on mechanical editing (e.g., consistency and correctness of punctuation, capitalization, spelling, hyphenation, parallelism, bibliographical references, illustrations, and headings) and substantive editing (rewriting, reorganizing, or suggesting other ways to present material). Staff

ENG 215 Principles of News and Article Writing. 3(3-0) F.S. Introduction to the techniques of conducting interviews and writing news stories (including feature articles) for a variety of news media. Staff

ENG 221 Communication for Business and Management. 3(3-0) F.S. Offers students in business, management, pre-law, and other non technical curricula the necessary communications skills to produce the routine and specialized reports required of managers and administrators in business, government, and industry. Topics of study include the public relations aspects of business writing; organizational, progress, and persuasive reports; sales, personnel, and form reporting; the use of forms in business, and routine and specialized business correspondence. Staff

ENG 298 Special Projects in English. 1-3 F.S. Staff

ENG 315 Reporting and Editing. Preq: ENG 215. 3(3-0) F.S. A journalism course in techniques of analyzing sources and readership; planning, organizing, and writing various kinds of articles, and editorial processes such as copyediting, headline writing, and page layout. Cockshutt, Rudner

ENG 321 The Communication of Technical Information. Preq: Junior standing. 3(3-0) F.S. Intensive training in the fundamentals of technical and scientific writing for students in scientific and technical curricula. Emphasis on day-to-day communications problems in their future careers and on the wide variety of formal and informal reports encountered in the scientific community. Staff

ENG 322 Advanced Writing: Persuasion and Agreement. Juniors and seniors only. 3(3-0) F.S. Rhetoric as a theory of communication, involving both psychological and social processes; and as a method for composition, involving invention, arrangement, and style. Traditional and modern views of rhetoric, emphasizing the differences between persuasion as manipulation and persuasion as the creation of agreement. Extensive practice in composing essays, letters, editorials; improvement through criticism and revision. Staff

ENG 323 Creative Writing. 3(3-0), Maximum 6, F.S. For students who have demonstrated ability. Emphasis on short prose fiction or poetry. Students may register in this course for a maximum of six hours. Barrax, Jeffers, Owen, Walters

ENG 324 Modern English. 3(3-0) F. A study of modern English primarily intended for candidates for teaching certificates. Attention given to problems of composition, dialect, and usage. Meyers, Short

ENG 326 History of the English Language. 3(3-0) S. A survey of the growth and development of the English language from its Indo-European sources to the present. Emphasis on detailed changes in sound, syntax, and meaning through this period. Holley, Meyers, Short

LITERATURE

The prerequisite for all 200 level literature courses is the completion of ENG 111 and ENG 112.

- ENG 205 Studies in Great Works of Literature.*** 3(3-0) F,S. Literary masterpieces 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. Staff
- 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. Staff
- ENG 208 Studies In Fiction.*** 3(3-0) F,S. 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. Staff
- ENG 261 English Literature I.** 3(3 0) F,S. Beginnings to 1660 Staff
- ENG 262 English Literature II.** 3(3 0) F,S. 1660 to present. Staff
- ENG 265 American Literature I.** 3(3-0) F,S. Beginnings to Civil War. Staff
- ENG 266 American Literature II.** 3(3-0) F,S. Civil War to present. Staff
- The prerequisite for all advanced courses in literature is the completion of ENG 111, 112, and one 200-level course in literature offered by the department.*
- ENG 305 Women in Literature: Female Characterization from Chaucer to the Present.** 3(3-0) S. Explores the nature of female characters as artistic entities to see these characters as part of literary and social convention. Emphasis on the feminist or antifeminist attitude of each work. Baines, Seidel
- ENG 346 Literature of the Western World I.** 3(3-0) F,S. The Search for Self: Readings from the earliest Hebraic and Greek literature to Dante. Smoot, Smith
- ENG 347 Literature of the Western World II.** 3(3-0) S. Crises and Confrontation: Readings from the European Renaissance to Tolstoi. Smoot
- ENG 362 The British Novel of the 18th Century.** 3(3-0) S. The British novel of the eighteenth century with emphasis on major novelists such as Defoe, Fielding, Smollett, Richardson, and Austen. Durant, C. Moore
- ENG 363 The British Novel of the 19th Century.** 3(3 0) F. The British novel of the nineteenth century with emphasis on major novelists such as Scott, Dickens, Thackeray, Eliot, and Trollope. Hargrave, King
- ENG 369 American Novel of the 19th Century.** 3(3 0) F. Reading and analysis of about twelve major novels that illustrate the development of the romantic novel (Brown, Cooper, Hawthorne, Melville), the realistic novel (DeForest, Twain, Howells, James), and the naturalistic novel (Norris, Crane, Dreiser), with additional readings in background and criticism. J. Clark, Knowles
- ENG 371 The Modern Novel.** 3(3 0) S. Background and pattern, and an analysis of major examples of the 20th-century novel. C. Moore, Reynolds
- ENG 372 Modern Poetry.** 3(3-0) S. Defining the "modern temper" by comparison of contemporary poetry with that of the past. Reading and analysis of individual poems. Owen, Reynolds
- ENG 375 The Film: A Literary Medium.** Preq: Jr. standing. 3(3-0) S. A survey and analysis of the development of the film into an art form with literary influences from its early days in the 1900's, through the advent of sound, to its present attainment as one of the influential media of the 20th Century. Hargrave, Rudner

*The courses ENG 207, 206, 207 and 208 are designed for students not enrolled in Humanities and Social Sciences.

- ENG 376 Fantasy and Science Fiction.** 3(3-0) S. A study of representative works, both novels and short stories, in the genre of Fantasy and Science Fiction. Emphasis on those works written in the twentieth century, with some attention given to the history and development of the genre.
Meyers, Seidel
- ENG 390 Classical Backgrounds of English Literature.** 3(3-0) F. Acquaints student with the central story matter of the ancient world Greek, Roman and Hebrew which has exerted such a profound influence on the civilization, and especially on the literature, of the Western world.
F. Moore, Wall
- ENG 391 Introduction to American Folklore.** 3(3-0) S. Principal types of folklore, combined with field work in collecting and assimilating materials from various cultural traditions. Emphasis on American folklore and its origins.
Betts, Prioli
- ENG 395 Black American Literature.** 3(3-0) F,S. A survey from significant beginnings to the present.
Barrax, Jeffers, Laryea
- ENG 398 Contemporary Literature I (1900 to 1940).** 3(3-0) F. Imaginative literature from the period 1900 1940 with emphasis upon themes and techniques rather than genre or nationality
E. Clark, Knowles, Reynolds
- ENG 399 Contemporary Literature II (1940 to present).** 3(3-0) S. Representative French, American, and British writers of the period 1940 to the present.
E. Clark, Knowles, Reynolds
- ENG 400 Studies in Applied Criticism.** Preq: Senior standing. 3(3-0) F,S. An introduction to the types and methods of literary criticism designed specifically for students intending to teach English.
Staff
- ENG 439 17th Century English Literature.** 3(3-0) S. Major nondramatic literary figures in England during the period 1600-1700.
Hester, F. Moore, White, Wall, Young
- ENG 449 The Renaissance.** 3(3-0) F. Nondramatic prose and poetry of the 16th century, with consideration of literary types and movements. Emphasis on the works of major authors.
P. Blank, Hester, Wall, Young
- ENG 451 Chaucer.** 3(3-0) F,S. Introduction to the study of Chaucer through an intensive reading of *The Canterbury Tales* and *Troilus and Criseyde*.
Holley, Koonce
- ENG 453 The Romantic Period.** 3(3-0) F. The poetry of Wordsworth, Coleridge, Byron, Shelley, and Keats, with reading in the prose of Lamb, DeQuincey, and others.
P. Williams, Hargrave, Harrison, King
- ENG 462 18th-Century English Literature.** 3(3-0) F. The major figures in English literature between 1660 and 1790 in the light of social, cultural, and religious change.
Durant, C. Moore, White
- ENG 463 The Victorian Period.** 3(3-0) S. Major poets and selected prose writers studied against the social, economic, scientific, and theological background of the century.
Hargrave, Harrison, King
- ENG 468 American Romanticism.** 3(3-0) F. Major American writers from 1825 to 1865.
E. Clark, J. Clark, Stein, West, Grimwood
- ENG 469 American Realism and Naturalism.** 3(3-0) S. Major American writers from 1865 to 1935.
E. Clark, J. Clark, Stein, West, Grimwood
- ENG 480 Modern Drama.** 3(3-0) F. Major plays from Ibsen to Albee.
Halperen, MacKethan
- ENG 485 Shakespeare.** 3(3-0) F,S. Principal plays with emphasis on the development of the playwright.
Baines, P. Blank, Hester, Wall, M. Williams, P. Williams
- ENG 486 Shakespeare, The Earlier Plays.** 3(3-0) F. May be taken (in conjunction with ENG 487) as alternate for ENG 485 in LAN and LTN curricula. A study of Shakespeare's major works before 1600 with emphasis on the development of the playwright. Credit will not be given for both ENG 485 and 486.
Baines, P. Blank, Hester, Wall, M. Williams, P. Williams

ENG 487 Shakespeare, The Later Plays. 3(3-0) S. May be taken (in conjunction with ENG 486) as alternate for ENG 485 in LAN and LTN curricula. A study of Shakespeare's major works after 1600 with emphasis on the development of Shakespeare's tragedy and the end of his career. Credit will not be given for both ENG 485 and 487.

Baines, P. Blank, Hester, Wall, M. Williams, P. Williams

ENG 496 Seminar in Literature. Preq: Junior standing and consent of department. 3(3-0) F,S. Designed to provide closely supervised small-group study of a topic in literature resulting in a substantial essay or series of essays by each student on an aspect of the topic. Topics vary each semester; consult department for details. Staff

ENG 498 Special Topics in English. Preq: Six hours ENG above the fr. level. 1 6 F,S. Detailed investigation of a topic in language or literature. Topic and mode of study determined by faculty member in consultation with English department head. Staff

ENG 499 Honors in English. For Honors English majors only. 3(3 0) F,S. An intensive course designed as one portion of the Honors Program in English. Subject varies. Staff

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 504 Problems in College Composition. Preq: Appointment as teaching assistant in English. 0 F. Directed study of the development of rhetorical skills in composition in classroom situations. C. Moore

ENG 561 Milton. 3(3-0) F. An intensive reading of Milton with attention to background materials in the history and culture of seventeenth-century England.

F. Moore, Wall, White

ENG 575 Southern Writers. 3(3-0) S. A survey of the particular contribution of the South to American literature, with intensive study of selected major figures.

Grimwood, MacKethan, Laryea

ENG 578 English Drama to 1642. 3(3-0) F. Intensive study of the English drama from its liturgical beginnings to the closing of the theatres, excluding Shakespeare.

Baines, Meyers, M. Williams

ENG 579 Restoration and 18th-Century Drama. 3(3 0) S. Intensive study of the English drama from 1660 to 1800. (Offered in 1980.)

Durant, F. Moore

ENG 590 Literary Criticism. 3(3-0) S. An examination of the critical process as it leads to the definition and analysis of literature, together with attention to the main literary traditions and conventions.

Holley, P. Williams

ENTOMOLOGY

ENT 201 Insects and Man. 2(2-0) F. The ways in which insects affect our lives today and how man deals with them, how they have altered the course of history, and how we may learn from them in studying their ability to adapt to their changing environments. The aesthetic and avocational aspects of insects. Intended for students not in biological sciences.

Moore

ENT 203 An Introduction to the Honey Bee and Beekeeping. 2(2-0) F. Provides a general introduction to honey bee biology and the fundamentals of bee management. The behavior and social system of the honey bee is stressed to expose the student to one of the animal world's most complex and highly organized nonhuman societies.

Ambrose

ENT 301 Introduction to Forest Insects. Preq: 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.

Farrier

ENT 312 Introduction to Economic Insects. 3(2-2) F,S. The fundamentals of insect classification, development, food habits and controls.

Moore

ENT (BS) 401 Bibliographic Research in Biology. Preq: Advanced undergraduate or graduate standing. 2(2-0) F 1978 and alt. yrs. Bibliographic principles, procedures, and tools useful in agriculture and biology and the many subdivisions of these sciences, including guides to and use of thesauri, bibliographies, library classifications, computer searches, books, serials, government publications, the unpublished, specialists, translations, atlases and maps, microforms, and projection software, and taxonomic indices to plants and animals.
Farrier
Farrier

ENT (ZO) 425 General Entomology. Preq: ZO 201 or equivalent. 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 an opportunity to collect insects and study their adaptations to a wide variety of natural environments.
Meyer

Selected 500-Level Courses Open To Advanced Undergraduates

ENT 502 Insect Diversity. Preq: Twelve hours of biology. 4(2-4) F. The external morphology of insects and a survey of the biology and identification of immature and adult insects. Evolutionary relationships of insects and other arthropods, speciation, insect zoogeography, nomenclature, and classical and recent approaches to systematics considered.
Baker, Neunzig, Young

ENT 503 Functional Systems of Insects. Preqs: Twelve hours of biology, nine hours of CH, three hours of BCH, ENT 301 or equivalent. 4(2-6) S. The morphology, histology and function of the organ systems of insects. Sensory and general physiology lead into basic elements of insect orientation and behavior.
Campbell, Yamamoto

ENT 504 Insect Morphology. Preq: ENT 502. 3(1-4) F. External morphology, primary and comparative phases, with emphasis on knowledge and techniques which can be applied to specific problems. (Offered F 1979 and alt. years.)
Young

ENT 511 Systematic Entomology. Preq: ENT 301 or 312. 3(1-4) F. A detailed survey of the orders and families of adult insects, to acquaint the student with those groups and develop ability in the use of the taxonomic literature. (Offered F 1978 and alt. years.)
Young

ENT 520 Insect Pathology. Preqs: Introductory entomology and introductory microbiology. 3(2-3) S. A treatment of the noninfectious and infectious diseases of insects, the etiological agents and infectious processes involved, immunological responses and applications. (Offered S 1979 and alt. years.)
Brooks

ENT 531 Insect Ecology. Preq: ENT 502. 3(2-2) F. The environmental relations of insects, including insect development, habits, distribution and abundance.
Hain, Kennedy, Stinner

ENT 541 Immature Insects. Preq: ENT 502 or equivalent. 2(1-3) F. An advanced study of the immature stages of selected orders of insects with emphasis on generic and specific taxa. Primary consideration of the larval stage, but a brief treatment of eggs and pupae. (Offered F 1978 and alt. years.)
Neunzig

ENT 542 Acarology. Preq: ENT 301 or 312 or ZO 201. 3(2-3) S. A systematic survey of the mites and ticks with emphasis on identification, biology and control of the more common and economic forms attacking material, plants and animals including man. (Offered S 1979 and alt. years.)
Farrier

ENT 550 Fundamentals of Insect Control. Preq: ENT 312 or 301. 3(2-2) F. The principles underlying modern methods for protecting food, clothing, shelter and health from insect attack.
Guthrie

ENT 562 Agricultural Entomology. Preq: ENT 301 or 312. 3(2-3) S. A study of the biology and ecology of beneficial and injurious insects and arachnids of agricultural crops. Advantages and limitations of the advanced concepts for managing insect and mite populations on different crops will be emphasized. (Offered S 1979 and alt. years.)
Bradley, Rock

ENT 570 Behavior of Insects. Preq: ENT 503 or ZO 510. 3(2-3) (F 1978 and alt. yrs.) A review of the sensory capacities, the central nervous system, and the endocrines of insects is

followed by simple neural coordinative and integrative mechanisms and species-typical behavior. The development (including learning), programming, and evolution of behavior are followed by complex behavior associated with sociality, ecological situations and stresses, and communications modes. Yamanoto

ENT 572 Advanced Forest Entomology. Preq: ENT 301 or ENT 502 or CL 3(2-2) S. Covers the important insect pests of forest and shade trees including regeneration pests, defoliating insects, inner bark borers, wood borers, sucking insects, and bud, twig and root feeding in sects. Also includes concepts in forest pest management and population dynamics. (Offered S 1980 and alt. years.) Hain

ENT (PHY, ZO) 575 Physiology of Invertebrates. 3(3-0) S. (See physiology.)

ENT (ZO) 582 Medical and Veterinary Entomology. Preqs: ENT 301 or 312 and ZO 315 or equivalent. 3(2-3) S. The morphology, taxonomy, biology and control of the arthropod parasites and disease vectors of man and animals. The ecology and behavior of vectors in relation to disease transmission and control. (Offered S 1980 and alt. years.) Axtell

ENT 590 Special Problems. Preq: CL Credits Arranged, F,S. Original research on special problems in entomology not related to a thesis problem. Provides experience and training in research. Staff

ENGINEERING OPERATIONS

EO 491 Seminar in Engineering Operations. Preq: Sr. standing. 1(1-0) F. Assists seniors in EO in making the transition from a college environment to that of industry through lectures, guest speakers and class discussion. Schedule during the last fall semester in residence. Easter

EO 495 Engineering Operations Projects. Preq: Junior or senior standing. 1-6. F,S. Special investigations and research projects related to engineering operations. Easter

ENGINEERING SCIENCE AND MECHANICS

ESM (CE) 308 Solid Mechanics II. Preq: MAE 314 or CE 313. 3(3-0). (See civil engineering.)

ESM (CE) 311 Experimental Engineering Science I. Coreqs: MAE 308, 208, 314. 3(1 6) F. (See civil engineering.)

ESM (CE) 312 Experimental Engineering Science II. Preq: CE (ESM) 311. 3(1-6). (See civil engineering.)

ESM (CE) 411, 412 Engineering Cybernetics I,II. Preq: Sr. standing in ESM or equivalent background. 3(1-4) F,S. (See civil engineering.)

ESM (CE) 415 Engineering Science in Contemporary Design. Preq: Sr. standing in ESM. 2(1-3) S. (See civil engineering.)

ESM (CE) 495 Special Studies in Mechanics. 1-3. (See civil engineering.)

COMPARATIVE LITERATURE

FCL 200 Perspectives in Comparative Literary Criticism. 3(3-0) S. An introduction to the theory of Comparative Literature and to problems of literary analysis, this course investigates the main trends and traditions of comparatist theory and practice.

FCL 300 Studies in Genres and Modes. Preq: FCL 200. Reading knowledge of a foreign language. 3(3-0) F. Each term the course investigates the evolution through different periods and literary traditions of a particular literary mode or genre, such as: the lyric poem, the pastoral, narrative, drama, comedy, satire.

FCL 310 Major Themes and Characters. Preq: FCL 200. Reading knowledge of a foreign language. 3(3 0) S. This course will focus on the literary treatment of one or several impor-

tant mythical, historical or philosophical themes or historical or archetypal characters, such as: Joan of Arc, Don Juan, Tristan, Faust, The French Revolution, Stoicism. Representative texts will be selected from a variety of literatures and periods.

FOREIGN LANGUAGES AND LITERATURES

NOTE: Following courses conducted in the target language, except where otherwise stated.

FL 101 Self-Instructional Elementary Language I. Preq: Consent of coordinator. 3(6-2) F.S. Study through self-instructional methods of a foreign language not otherwise taught in the department. Students work with native speakers and proceed at their own pace. Admission to the program is limited to highly motivated students and is determined by a language aptitude test and an interview with the program coordinator.

FL 102 Self-Instructional Elementary Language II. Preq: Consent of coordinator. 3(6-2) F.S. (See course description under FL 101).

FL 201 Self-Instructional Intermediate Language I. Preq: Consent of coordinator. 3(6-2) F.S. (See course description under FL 101).

FL 202 Self-Instructional Intermediate Language II. Preq: Consent of coordinator. 3(6-2) F.S. (See course description under FL 101).

FL 298 Special Topics in Foreign Languages and Literatures. Preq: Consent of department. 1-3 F.S. A special projects course to be utilized for supervised work in language and literature when no scheduled course is appropriate.

FL 498 Special Topics in Foreign Languages and Literatures. Preq: Consent of department. 1-6 F.S. A detailed investigation of a special topic in language and/or literature. Topic, mode of study and variable credit to be determined by the faculty member in consultation with the head of the Department of Foreign Languages and Literatures.

ENGLISH FOR FOREIGN STUDENTS

FLE 101 Foreign Language English: Grammar Review. Preqs: TOEFL Test-score of 450 or above and departmental placement tests. 3(3-1) F.S. Review of basic word order patterns, inflectional forms, and function words of spoken English, drill on statement and question patterns, and practice in constructing original patterns. Emphasis is on comprehension and production of grammatically correct spoken English.

FLE 102 Foreign Language English: Writing. Preqs: TOEFL Test-score of 450 or above and departmental placement tests. 3(3-1) F.S. Paragraph writing including drill on topic sentences, logical organization, and use of transitional expressions to show relationships. The writing of short compositions of various types (narration, description, exposition, analysis, comparison, and contrast). Drill on mechanics such as spelling, punctuation, and capitalization when needed. Introduction to techniques for writing and research paper (note taking, outlining, summarizing, footnoting, and the writing of a bibliography).

FLE 103 Foreign Language English: Conversation. Preqs: TOEFL Test-score of 450 or above and departmental placement tests. 3(3-1) F.S. Designed for students who need additional conversational practice in order to comprehend native speakers and be understood by them. Emphasis is on correct pronunciation stress and intonation, and use of idiomatic expressions. Aural comprehension exercises, oral drills, class discussions, and language laboratory practice.

FLE 104 Foreign Language English: Reading Improvement. Preqs: TOEFL Test-score of 450 or above and departmental placement tests. 1(1-0). This course is designed for foreign students who need to improve their reading speed and comprehension in order to perform effectively in other academic courses. Timed drills and practices teach the students to respond rapidly and accurately to increasingly longer units of writing. Use of the dictionary and vocabulary building exercises are also included.

FRENCH LANGUAGE AND LITERATURE

NOTE: All students with previous knowledge of French, German or Spanish must take the placement test upon entering the University. They will be given advanced standing and receive credit according to their score.

FLF 101 Elementary French I. 3(3-0) F,S. The beginning course for developing language skills. Oral and written practice in classroom and language laboratory.

FLF 102 Elementary French II. Preq: FLF 101. 3(3-0) F,S. A continuation of FLF 101, with oral and written practice in classroom and language laboratory.

FLF 103 Elementary French I Conversation. Coreq: FLF 101. Credit in this course may be used as free elective only. 1(1-0) F,S,Sum. Supplements conversational practice in FLF 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.

FLF 104 Elementary French II Conversation. Coreq: FLF 102. Credit in this course may be used as a free elective only. 1(1-0) F,S,Sum. Supplements conversational practice in FLF 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.

FLF 105 Intensive Elementary French. 6(6-0) F. An intensive course for developing language skills. Oral and written practice in classroom and language laboratory. Same as FLF 101 and FLF 102.

FLF 201 Intermediate French I. Preq: FLF 102 or 105. 3(3-0) F,S. The third of four consecutive courses to build skills of speaking, understanding, reading and writing French. Oral and written practice in classroom and language laboratory.

FLF 202 Intermediate French II. Preq: FLF 201. 3(3-0) F,S. Last of the foundation courses in French. Greater emphasis on reading and writing.

FLF 203 French Conversation. Preq: FLF 102 or 105. 1(1-0) F,S. Practice in spoken French, emphasizing active use of the language in a variety of situations. The student is encouraged to increase vocabulary, while developing greater fluency and ease in the structural patterns of the language. May be repeated to a maximum of three credit hours.

FLF 205 Intensive Intermediate French. Preq: FLF 101 and 102 or 105. 6(6-0) S. An intensive study of French on the intermediate level with increased emphasis on reading and writing skills. Oral and written practice in classroom and language laboratory. Same as FLF 101 plus 102.

FLF 251 Exoticism and the Fantastic in French Literature. 3(3-0) F. Exoticism and the Fantastic in French Literature. Readings of important works of French literature, selected among novels, short stories, and other forms which make use of the exotic or the fantastic in the dissemination of new critical or philosophical ideas. In-depth analysis and explication of works from the 16th century to the present. All readings and discussion in English.

FLF 257 Modern French Drama. 3(3-0) S. Trends in twentieth-century French theatre, including surrealism, existentialism and the absurd, as illustrated in selected works of Beckett, Ionesco, Genet, Sartre, Giraudoux and Cocteau. All readings and discussion in English.

FLF 301 Survey of French Literature, Origins to 1800. Preq: FLF 202 or 205. 3(3-0) F. Readings or representative works with analytical and critical emphasis. Lectures, written and oral reports.

FLF 302 Survey of French Literature, 1800 to Present. Preq: FLF 202 or 205. 3(3-0) S. Readings of representative works with analytical and critical emphasis. Lectures, written and oral reports.

FLF 309 Advanced French Conversation and Phonetics. Preq: FLF 202 or 205. 3(3-0) F,S. Study of sound production and phonological terminology. Daily conversational practice in classroom. Prose and poetry readings.

FLF 310 Advanced French Grammar. Preq: FLF 202 or 205. 3(3-0) F,S. Thorough and in-depth study of French syntax with extensive written practice. Required of French majors.

FLF 315 French Civilization and Culture. Preq: FLF 202 or 205. 3(3-0) S. Taught in French. This course provides a background in French civilization and culture, thorough reading, discussion and presentation of the social, economic and political structures of France, along with its geography, history, music and art.

FLF 322 French Novel Before World War II. Preq: FLF 202 or 205. 3(3-0) F,S. Readings of French novelists from 1900 to 1940. Lectures, written and oral reports.

FLF 323 Contemporary French Novel. Preq: FLF 202 or 205. 3(3-0) F,S. Readings of French novelists from 1945 to the present. Lectures, written and oral reports.

FLF 324 Contemporary French Theater. Preq: FLF 202 or 205. 3(3-0) F,S. Representative plays with stress on ideas, philosophies, and trends in France and other countries.

FLF 350 Modern European Literary Criticism. Preq: Six hours of literature. 3(3-0) F,S. A study of modern European literary criticism paralleling the major modern philosophical systems, as theoretical bases, and based on an examination of major French critics, as applied methods. These methods are applied to several texts by French authors covering various genres. Taught in English.

FLF 352 Protest in Negritude Literature. 3(3-0) S. A survey of Negritude literature of French expression with emphasis on the theme of protest. Taught in English.

FLF 411 French Literature of the 17th Century. Preq: CI. 3(3-0) F,S. Analytical and critical study of writings of French Classicism. Lectures, written and oral reports.

FLF 412 French Literature of the 18th Century. Preq: CI. 3(3-0) F,S. Analytical and critical study of writings of the Age of Rationalism and Revolution. Lectures, written and oral reports.

FLF 492 Seminar in French Studies. Preq: Junior standing and consent of department. 3(3-0) F. A small-group study of a topic in literature resulting in a substantial essay or series of essays by each student on an aspect of the topic. Topics vary each semester.

FLF 495 Special Topics in French Studies. Preq: FLF 202 and consent of department. 3(3-0). A concentrated study of a special period, author or genre, to be determined as needed in the major program.

GRADUATE CERTIFICATION ONLY

FLF 401 French for Graduate Students. Not open to undergraduates. 3(3-0) F. Designed to prepare students for graduate certification, this course will introduce students to basic vocabulary and structures. Frequent practice in translation. Certification is granted on satisfactory completion of the course.

GERMAN LANGUAGE AND LITERATURE

NOTE: All students with previous knowledge of French, German or Spanish must take the placement test upon entering the University. They will be given advanced standing and receive credit according to their score.

FLG 101 Elementary German I. 3(3-0) F,S. 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. Strong emphasis is placed on understanding and speaking, but increasing attention is given to syntax and vocabulary building.

FLG 103 Elementary German I Conversation. Coreq: FLG 101. Credit in this course may be used as free elective only. 1(1-0) F,S,Sum. Supplements conversational practice in FLG 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.

FLG 104 Elementary German II Conversation. Coreq: FLG 102. Credit in this course may be used as free elective only. 1(1-0) F,S,Sum. Supplements conversational practice in

FLG 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.

FLG 201 Intermediate German I. Preq: FLG 102. Credit for both FLG 201 and FLG 210 is not allowed. 3(3-0) F.S. The third of four consecutive courses. Intensive conversational drill to build the students' ability to understand and speak everyday German. Supplementary readings in German literature.

FLG 202 Intermediate German II. Preq: FLG 201. Credit for both FLG 202 and FLG 211 is not allowed. 3(3-0) F.S. Last of four sequential courses. Continued use of everyday spoken German but greater emphasis on reading and writing.

FLG 210 German Practicum I. Preq: FLG 102. Credit for both FLG 201 and FLG 210 is not allowed. 3(3-0) S. Alt. years. The first in a three-semester sequence which emphasizes everyday spoken German, acquaints the student with contemporary Germany, her people, institutions, and geography, and prepares the student for a living, working, and study situation in Germany. This sequence may lead to the diploma "Zertifikat Deutsch als Fremdsprache." The course is conducted entirely in German.

FLG 211 German Practicum II. Preq: FLG 210. Credit for both FLG 202 and FLG 211 is not allowed. 3(3-0) F. Alt. years. The second in a three-semester sequence which emphasizes everyday spoken German, acquaints the student with contemporary Germany, her people, institutions, and geography, and prepares the student for a living, working, and study situation in Germany. This sequence may lead to the diploma "Zertifikat Deutsch als Fremdsprache." The course is conducted entirely in German.

FLG 212 German Practicum III. Preq: FLG 211. 3(3-0) S. Alt. years. The third in a three-semester sequence which emphasizes everyday spoken German, acquaints the student with contemporary Germany, her people, institutions, and geography, and prepares the student for a living, working, and study situation in Germany. This sequence may lead to the diploma "Zertifikat Deutsch als Fremdsprache." The course is conducted entirely in German.

FLG 254 The Novelle From Goethe to the First World War. 3(3-0) S. Study of a major form of German prose fiction from Goethe to Thomas Mann with special attention to theoretical formulations. All readings and discussion in English.

FLG 255 Modern German Drama. 3(3-0) F. A study of contemporary German drama and significant plays of earlier literary movements which have contributed to the drama in Germany today. Some representative playwrights are: Büchner, Hauptmann, Wedekind, Brecht, Dürrenmatt, Frisch, Weiss, Handke and Hochhuth. All readings and discussion in English.

FLG 301 Survey of German Literature: Middle Ages to 1800. Preq: FLG 202. 3(3-0) F.S. Readings of representative works with analytical and critical emphasis. Lectures, class discussions, papers.

FLG 302 Survey of German Literature: 1800 to World War I. Preq: FLG 202. 3(3-0) F.S. Readings of significant authors, including the Romantic, Realist and Impressionist periods.

FLG 309 Advanced German Conversation and Phonetics. Preq: FLG 202. 3(3-0) F.S. Intensive conversational practice in class and language laboratory based on current topics, and a study of sound production and linguistic terminology.

FLG 310 Advanced German Syntax and Composition. Preq: FLG 202 or equivalent. 3(3-0) F. A study of advanced points in German syntax not normally studied in depth during the two years of beginning and intermediate courses. Students write controlled exercises and assigned and free compositions. Includes a bibliographical practicum.

FLG 322 Major German Modern Writers. Preq: FLG 202. 3(3-0) F. A study of major authors of the 20th century whose reputations were established prior to World War II, including Hauptmann, Schnitzler, Hofmannstahl, Hesse, Mann, Kafka, Brecht.

FLG 323 Contemporary German Literature. Preq: FLG 202. 3(3-0) S. A study of German-speaking authors whose reputation has been established since the Second World War and those whose works are now gaining attention.

GRADUATE CERTIFICATION ONLY

FLG 401 German for Graduate Students. Not open to undergrads. 3(3-0) F. Designed to prepare students for graduate certification, this course will introduce students to basic vocabulary and structure. Successful completion of the course will certify the student's reading knowledge.

HEBREW LANGUAGE AND LITERATURE

FLH (REL) 101 Elementary Biblical Hebrew I. 3(3-0) F. Alt. yrs. (See religion.)

FLH (REL) 102 Elementary Biblical Hebrew II. Preq: REL (FLH) 101. 3(3-0) S. Alt. yrs. (See religion.)

FLH (REL) 201 Intermediate Biblical Hebrew I. Preq: REL (FLH) 102. 3(3-0) F. Alt. yrs. (See religion.)

ITALIAN LANGUAGE AND LITERATURE

FLI 101 Elementary Italian I. 3(3-0) F,S. Concentrating on listening and speaking, this course begins the development of a balanced foundation on all four language skills. Idiomatic, everyday Italian is emphasized. Class and laboratory practice, written homework.

FLI 102 Elementary Italian II. Preq: FLI 101. 3(3-0) F,S. Emphasis mainly on acquisition of oral skills through class practice and use of audio aids. Readings of simple Italian prose.

FLI 201 Intermediate Italian I. Preq: FLI 102. 3(3-0) F. The third of four consecutive courses to build skills in reading, writing, and speaking Italian. Conversation practice, written exercises, and supplementary readings in Italian Literature.

FLI 202 Intermediate Italian II. Preq: FLI 201. 3(3-0) S. Continued use of spoken Italian but a greater emphasis on reading and writing.

PORTUGUESE LANGUAGE AND LITERATURE

FLP 105 Intensive Elementary Portuguese. 6(6-0) F. Intensive introduction to Brazilian Portuguese, with emphasis on the speaking and listening skills.

FLP 205 Intensive Intermediate Portuguese. Preq: FLP 105. 6(6-0) S. Intensive study of Brazilian Portuguese on the intermediate level with refinement of the listening and speaking skills and introduction of the reading and writing skills.

RUSSIAN LANGUAGE AND LITERATURE

FLR 101 Elementary Russian I. 3(3-0) F,S. The first of four sequential courses. Students are introduced to the basic language skills: understanding, speaking, reading and writing. Initial emphasis is on the two first, or oral, skills. Class and laboratory practice; written assignments.

FLR 102 Elementary Russian II. Preq: FLR 101. 3(3-0) F,S. Main emphasis on acquisition of basic oral skills, with complementary reading and writing exercises. Class and laboratory practice; written assignments.

FLR 201 Intermediate Russian I. Preq: FLR 102. 3(3-0) F,S. The learning of basic skills is continued. More emphasis than previously will be given to writing, but conversational practice is essential. Readings in Russian prose of intermediate level. Class and laboratory practice; written assignments.

FLR 202 Intermediate Russian II. Preq: FLR 201. 3(3-0) F,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 I. 3(3-0) F,S. This course offers an introduction to Russian writers of the 19th century, such as Turgenev, Gogol, Lermontov, Pushkin, Dostoevsky, Tolstoy. Class conducted in English.

FLR 304 Russian Literature in Translation II. 3(3-0) F,S. An introduction to Russian writers of the 20th century: Gorky, Pasternak, Solzhenitsyn, Babel, Sholokov, Maiakovsky, etc. Class conducted in English.

SPANISH LANGUAGE AND LITERATURE

NOTE: All students with previous knowledge of French, German or Spanish must take the placement test upon entering the University. They will be given advanced standing and receive credit according to their score.

FLS 101 Elementary Spanish I. 3(3-0) F,S. Concentrating on listening and speaking, this course begins the development of a balanced foundation in all four language skills. Idiomatic, everyday Spanish is emphasized. Class practice, laboratory and written homework.

FLS 102 Elementary Spanish II. Preq: FLS 101. 3(3-0) F,S. This course expands use of Spanish through past tenses, regular and irregular, and various morphological and syntactical aspects. Emphasis on oral skills. Written work and laboratory practice assigned daily.

FLS 103 Elementary Spanish I Conversation. Coreq: FLS 101. Credit in this course may be used as a free elective only. 1(1-0) F,S,Sum. Supplements conversational practice in FLS 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.

FLS 104 Elementary Spanish II Conversation. Coreq: FLS 102. Credit in this course may be used as a free elective only. 1(1-0) F,S,Sum. Supplements conversational practice in FLS 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.

FLS 105 Intensive Elementary Spanish. 6(6-0) F. An intensive introduction to idiomatic Spanish concentrating on developing a balanced foundation in listening, speaking, reading and writing. Class practice, laboratory and written assignments. Same as FLS 101 plus 102.

FLS 201 Intermediate Spanish I. Preq: FLS 102 or 105. 3(3-0) F,S. The third of four consecutive courses. As with 101 and 102, its aim is mainly to teach idiomatic, spoken Spanish. Reading and writing skills receive greater attention than previously. Class practice, laboratory and written assignment.

FLS 202 Intermediate Spanish II. Preq: FLS 201. 3(3-0) F,S. Last of four sequential courses, completing the learning of the foundations of the language. Writing will receive greater attention.

FLS 203 Spanish Conversation. Preq: FLS 102 or 105. 1(1-0) F,S,Sum. Practice in spoken Spanish. The student is required to actively use the language in a variety of situations and is encouraged to acquire a wide range of immediately practical words and expressions suitable for business or travel purposes. The course may be repeated to a maximum of three times for credit.

FLS 205 Intensive Intermediate Spanish. Preqs: FLS 101 and 102 or 105. 6(6-0) S. An intensive study of idiomatic Spanish on the intermediate level with increased emphasis on reading and writing skills. Class practice, laboratory and written assignments. Same as FLS 201 plus 202.

FLS 252 The Theme of "Desengano" in Spanish Literature. 3(3-0) F. Comprehensive study of the theme of "Desengano" in its different forms and manifestations in the Spanish Golden Age Literature. The course material is made up of representative examples of the Picaresque Novel, Mysticism, Baroque Drama and Poetry, and Don Quixote. All readings and discussion in English.

FLS 256 Alienation in Modern Hispanic Literature. 3(3-0) S. A study of contemporary prose literature in the Hispanic countries, with readings of selected Spanish and Latin American essays, novels, and stories. Special emphasis is given to the recurring theme of the individual alienated from society. All readings and discussion in English.

FLS 301 Survey of Spanish Literature Through Golden Age. Preq: FLS 202 or 205. 3(3-0) F. Analysis of major literary works through 1700. The study will have two main projections: aesthetic, through consideration of elements of artistic creation, criticism and genres; cultural, in relating works to spatial and temporal circumstance.

FLS 302 Survey of Spanish Literature: 1700 to Present. Preq: FLS 202 or 205. 3(3-0) S. Introduction to the study of Spanish Neoclassicism, Romanticism, Realism, and subsequent literary production. Special attention to the quest for new values in contemporary literature.

FLS 303 Latin American Literature I. Preq: FLS 202 or 205. 3(3-0) F. Survey of literary production in Spanish American countries from pre-Hispanic to 1800. Special attention to the Baroque and the Romantic periods to 1800. Lectures, class discussions, papers.

FLS 304 Latin American Literature II. Preq: FLS 202 or 205. 3(3-0) S. Introduction to the study of American literature in the Spanish language from Modernism to García Márquez. Lectures, class discussions, papers.

FLS 309 Spanish Phonetics and Advanced Conversation. Preq: FLS 202 or 205. 3(3-0) F.S. Through discussions on relevant topics, class will concentrate on improving students' fluency in spoken Spanish. Study of main phenomena of sound production and relevant linguistic terminology.

FLS 310 Spanish Syntax and Composition. Preq: FLS 202 or 205. 3(3-0) F,S. A thorough study of the more advanced aspects of the grammar of the Spanish language, with extensive practice in writing. Lectures, discussion, compositions.

FLS 315 The Culture and Civilization of Spain and Portugal. Preq: FLS 202 or 205. 3(3-0) F. Taught in Spanish. The study of the Iberian Peninsula as a crossroads of civilization from early times to the present. The emergence of Spain as a nation, the rise and fall of the Spanish Empire, the contemporary political situation in Spain and Portugal. Films, recordings, slides, and visiting speakers illustrate those cultural characteristics unique to the Iberians.

FLS 316 The Culture and Civilization of Latin America. Preq: FLS 202 or 205 3(3-0) S. Taught in Spanish. This course surveys the rich cultural traditions of Latin America. Through readings, slides, films, and recordings, the variety and complexity of the Latin Americans' cultural heritage is demonstrated.

FLS 323 Contemporary Spanish Literature. Preq: FLS 202 or 205. 3(3-0) F. An in-depth study of Spanish prose writing from the Generation of 98 through the present. Special attention to post Civil War authors such as Laforet, Cela, Goytisolo, etc. Lectures, discussions, term paper.

FLS 403 Spanish Prose Fiction to 1900. Preq: Consent of department. 3(3-0) F. A study of the development of the Spanish novel and short story from *La celestina* through the novels of Galdos. Major emphasis is given to the picaresque novel, *Don Quixote*, eighteenth-century didactic prose, and nineteenth-century Realism.

FLS 404 Spanish Drama. Preq: Consent of department. 3(3-0) S. Explores the history and development of Spanish drama from its beginning to the present. Special emphasis on Golden Age and contemporary theater.

FLS 492 Seminar in Hispanic Studies. Preq: Junior standing and consent of department. 3(3 0) F. A small-group study of a topic in literature resulting in a substantial essay or series of essays by each student on an aspect of the topic. Topics vary each semester.

FLS 495 Special Topics in Hispanic Studies. Preq: FLS 202 and consent of department. 3(3 0). A concentrated study of a special period, author or genre in Hispanic Literature, to be determined as needed in the major program.

GRADUATE CERTIFICATION ONLY

FLS 401 Spanish for Graduate Students. Not open to undergrads. 3(3-0) F. Designed to prepare students for graduate certification, this course introduces students to basic vocabulary and structures. Frequent practice in translation. Certification is granted on satisfactory completion of the course.

FORESTRY

- FOR 101 Introduction to Forestry.** 1(1-1) F. Introduction to the School of Forest Resources, to the profession of forestry and to career opportunities in forestry. Staff
- FOR 201 Introduction to Forest Mensuration.** 2(1-2) F,S. Theory, principles and techniques of instrumentation relative to the collection and presentation of forest data. Staff
- FOR 204 Silviculture.** Summer Camp. 2(0-6) Sum. Field exercises to enable the student to describe and measure factors of the forest environment, the ecology of forest communities, stand structure and growth, and tree and stand response to treatments which are normal parts of forest management operations. Jervis
- FOR 210 Dendrology-Gymnosperms.** Preq: BO 200. 2(1-2) S. Identification, relationships and distribution of gymnosperm trees, emphasizing characteristics of genera and higher taxonomic groups. Staff
- FOR 211 Dendrology-Angiosperms.** Preq: BO 200. 2(1-2) F. Identification, relationships and distribution of angiosperm trees, emphasizing characteristics of genera and higher taxonomic groups. Staff
- FOR 219 Forest Economy and its Operation.** Preq: EB 212 or 201. 3(2-2) F. Multiple use concept of forestry; economic principles underlying production; investment problems; factors which influence demand for forest products. Steensen
- FOR 263 Dendrology.** Summer camp. Preq: FOR 210, 211. 1(0-3) Sum. Field identification of woody plants trees, shrubs and vines with consideration of their habitat and ecology. Emphasis on spontaneous species of the Piedmont and mountain regions of North Carolina. Staff
- FOR 264 Forest Protection.** Summer camp. Preq: Jr. standing in FOR. 2(0-6) Sum. Identification and control of forest insects and diseases. Behavior of fire and the meteorological factors affecting fire behavior, suppression of a large simulated fire, including use of modern ground equipment, aircraft and communications systems. Staff
- FOR 272 Forest Mensuration.** 3(2-2) S. Scientific basis for the measurements and estimates required in forest resources management and goods and services derived from forest land. Includes theory of measurements, the required procedures, instrumentation and statistical prerequisites, with emphasis on sampling problems. Steensen
- FOR (WPS) 273 Quantitative Methods in Forest Resources.** Preq: Soph. standing. 3(2-2) F,S. Problem solving techniques in forestry, wood technology, pulp and paper technology and recreation resources. Historical development of past techniques, assessment of present technology, and an evaluation of problem solving tools, including an introduction to computers. Gemmer
- FOR 274 Mapping and Mensuration.** Summer camp Preq: FOR 272. 4(0-12) Sum. Use of surveying instruments and graphic methods in preparation of topographic and planimetric maps of forested areas. Collection and manipulation of timber volume data on fixed and variable plot cruises and the writing of an inventory report. Jervis, Steensen
- FOR 284 Utilization.** Summer camp. Preq: Jr. standing in FOR. 1(0-3) Sum. Inspection of wood industries; expositions on manufacturing processes. Staff
- FOR (PP) 318 Forest Pathology.** Preq: BS 100 or equivalent. 4(3-2) S. (See plant pathology.)
- FOR 353 Air Photo Interpretation.** Preq: Jr. Standing. 3(2-3) S. Theory, principles and techniques of utilizing air photos as data sources for planning and management of renewable resources. Particular attention to stereoscopic identification and examination of the bioecological factors of terrain, plants, growing conditions, water, wildlife and the changes brought about by man's activities. Sullivan
- FOR 405 Forest Land Management.** Preqs: FOR 272, 452. 5(2-6-2) F. Management of forest lands for multiple benefits. Principles and techniques in regulating regeneration, species composition, growth and quality of woody vegetation; use of planting, seeding, cutting, herbicides and fire in vegetation management. Application of financial principles to decisions regarding investments in forest management. Staff

FOR 406 Forest Land Inventory and Planning. Preq: FOR 405. 6(2 14) S. A continuation of FOR 405. The application of land management systems and related problems of land use in the evaluation of an assigned forest area. Students complete a resource inventory and analysis and submit individual plans for management of the assigned property. Staff

FOR 411 Forest Tree Improvement. Preq: Junior or senior standing in forestry. 3(3-0) S. Emphasis is on the value and implementation of tree improvement in forest management. Study is made of genetics of forest trees, natural variation and evolution of plants, use of indigenous vs. exotic species, tree selection and propagation, seed orchard establishment and management, progeny testing, hardwood regeneration and management, site preparation, variation in wood properties and methods of maximizing fiber production. Zobel

FOR (WPS) 423 Engineering Applications in Forest Resources. Preq: Junior standing. 3(2 3) F. Applications of engineering principles to problems in the forest industry including harvesting, log transportation, road layout, regeneration, 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; cost analysis and systems selections; traction devices and vehicle mechanics. Hassan

FOR 452 Silvics. Preqs: BO 200, CH 103, PY 221 or 212, MA 212 or equivalent. Course is designed for second semester juniors. 4(3-4) S. Involves integration of the knowledge gained in previous courses in order to manipulate the environment, manipulate the genotype, and manipulate plant competition so that trees will grow bigger, better, and faster. Applications to both forest and urban situations are presented. Perry

FOR 462 Artificial Forestation. 2(1-2) S. Biology of seed production by forest trees; forest tree seed collection, extraction, storage and testing; biology of tree seedling growth; soil aspects of nursery management; forest nursery operation; soil aspects of site preparation, planting and direct seeding; reforestation operations. (Offered S 1978 and alt. yrs.) Davey

FOR 472 Renewable Resource Management. Preq: A basic course in biology and economics; jr. or sr. standing. (Not open to FOR majors.) 3(3-0) S. Concepts and problems of coordinated use and management of renewable resources—soil, water, vegetation and fauna. Man as a biological factor interacting with other components of terrestrial ecological systems, particularly forests and related communities. Consideration of interrelationships of forests, water, range-land, wildlife and outdoor recreation and their aesthetic and economic values. Inventory and management techniques and economic policies relating to renewable resources. Cooper

FOR 491 Senior Problems in Forestry. Preq: Consent of department. Credits Arranged. Faculty approved problems in management or technology. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

FOR 501 Forest Influences and Watershed Management. Preq: Advanced undergrad. or grad. standing. 3(3-0) F. Study of the effects of woody vegetation on climate, water, and soil, with applications of the knowledge of forest influences to management of forest land resources including conservation and yield of water, stabilization of streamflow and soils, reduction of sedimentation and general improvement of the environment. Gregory

FOR 512 Forest Economics. Preq: Basic course in economics. 3(3-0) S. Economics and social value of forests; supply of, and demands for forest products; land use; forestry as a private and a public enterprise; economics of the forest industries. Holley

FOR 571 Advanced Forest Mensuration. Preqs: FOR 272, ST 311. 3(2-2) F. Study of the development of mathematical models to describe forest resources phenomena; criteria for evaluating the "goodness" of such models; and methods of data collection for use in evaluation. Hafley

FOR 572 Conservation Policy Issues. Preq: Advanced undergrad. or grad. standing. 3(3-0) S. Analysis of the attitudes of selected private groups and public agencies toward multiple resource development. Special attention given to forest resource policies, timber management objectives, private industry activity, recreation and multiple use, education, research,

watersheds, governmental activity, interaction in international forestry affairs and the role of professional foresters in multiple-use resource management. Cooper

FOR 591 Forestry Problems. Preq: Advanced undergrad. or grad. standing. Credits Arranged. Assigned or selected problems in the field of silviculture, harvesting operations, lumber manufacturing, policy, wood science, pulp and paper science, wood chemistry or forest management. Graduate Staff

FOR 599 Methods of Research in Forestry. Preq: Advanced undergrad. or grad. standing. Credits Arranged. Research procedures, problem analysis, working plan preparation, interpretation and presentation of results; evaluation of selected studies by forest research organizations; techniques and constraints in the use of sample plots. Graduate Staff

FOOD SCIENCE

FS 201 Food Science and Man's Food. 3(3-0) F,S. An introduction to the science and practice of providing man with a wholesome, nutritious, economical and readily available supply of basic and processed foodstuffs. Topics will include: man's struggle for food; chemical nature of foods; microorganisms and foods; safety of foods; principles of food preservation and processing; organic and health foods; nutrition and the consumer; world food problem. Warren

FS (ANS, NTR) 301 Nutrition and Man. Preq: Two years of college work. 3(3-0) F,S. (See nutrition.)

FS 331 Food Engineering. Preq: PY 211 or 221. 3(2-3) F. Engineering concepts application to the food industry. Principles of thermodynamics, fluid flow, heat transfer, refrigeration and electricity. Jones

FS 400 Foods and Nutrition. Preq: CH 220. 3(3-0) S. Alt. yrs. The sources and properties of nutrients for man will be studied. Factors affecting the supply and availability of foods will also be considered. Methods of handling, procuring and preserving foods and the changes in the values and characteristics of nutrients resulting from these processes will be emphasized. Aurand

FS 402 Food Chemistry. Preq: CH 220 or 221. 3(3-0) 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. Aurand

FS (PO) 404 Poultry Products. Preq: CH 220 or 221. 3(2-3) F. The composition, quality, processing and preservation of poultry meat and eggs. Ball

FS (MB) 405 Food Microbiology. Preq: MB 401. 3(2-3) F. The microorganisms of importance in foods, and their cultural and metabolic activities. The physical and chemical destruction of microorganisms in foods and kinetics involved. The conversion of raw foods by microorganisms into altered foods, and the nutrition, growth and preservation of the culture involved. Foods as vectors of human pathogens. The evolution of microbiological standards for foods. Adams

FS (ANS) 409 Meat and Meat Products. Preq: CH 220. 3(2-3) S. The basic principles involved in processing beef, pork and lamb from the live animal to the various representative cured, fresh, canned and comminuted meat items currently produced. Blumer

FS (BAE) 432 Food Engineering II. Preq: FS 331. 3(2-3) S. Alt. yrs. The theory and principles of evaporation, drying and distillation with emphasis on applications in food processing. Instrumentation and control systems used in the food industry. Jones

FS 490 Food Science Seminar. Preq: Sr. standing. 1(1-0) F. A review and discussion of scientific articles, new developments and topics of current interest. Roberts, Warren

FS 491 Special Topics in Food Science. Preq: Sr. standing or CL 1 6 F,S,Sum. Topics are selected or assigned. Study of current topics and/or problems to gain additional knowledge and interpretative experience in a specific area. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

FS 503 Food Analysis. Preqs: CH 315, BCH 351, FS 402. 3(1-6) S. A study of the principles, methods and techniques necessary for quantitative physical and chemical analysis of food and food products. Results of analyses evaluated in terms of quality standards and governing regulations. Young

FS 504 Food Proteins and Enzymes. Preq: FS 402 or BCH 351. 3(2-3) Alt. F. An advanced course in food chemistry with emphasis on proteins and enzymes of particular importance to foods will be presented. Protein interactions and their effect on the physical-chemical characteristics of a product will be discussed. Particular emphasis will be given to the preparation and kinetic properties of immobilized enzymes and their use as biochemical reactors in processing operations or as specific electrodes for analytical purposes. Swaisgood

FS (MB) 506 Advanced Food Microbiology. Preq: FS (MB) 405 or equivalent. 3(1-6) S. The interactions of microorganisms in foods and their roles in food spoilage and bioprocessing. Cellular and molecular relationships in bacterial injury, repair and aging resulting from environmental stresses. Bacterial sporulation, germination, and physiological properties of bacterial spores. Klaenhammer

FS 511 Food Research and Development. Preqs: FS 331, FS 402, FS (MB) 405. 3(2-3) S. A study of the scientific principles underlying the development of new and improved food products and processes. The study of specific food industry problems by the case method. Special emphasis on the application of research and development principles to meat, poultry, and fisheries industries. Lanier

FS 516 Quality Control of Food Products. Preqs: FS 331, FS 402, FS (MB) 405. 3(2-3) S. A study of quality control fundamentals in the food industry including specifications and standards, testing procedures, sampling, statistical and quality control, and organization. Food products and industry problems with special emphasis on dairy products. Adams

FS (HS) 521 Food Preservation. Preqs: MB 401 or FS (MB) 405, FS 402, or BO 421. 3(2-3) F. An examination of principles and 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 (HS) 562 Post-Harvest Physiology. 3(3 0) S. (See horticultural science.)

FS (BAE) 585 Biorheology. Preqs: PY 205, MAE 314. 3(2-2) Alt. S. The concepts of strain, stress and the mechanical viscoelastic properties of biological solids, fluids and slurries. The time-dependent deformation and flow of bio materials elements of strength of materials, rheological equations and model concepts, creep-relaxation and dynamic behavior, contact problems and the Boltzman superposition principle as a function of time, temperature and moisture content. Hamann

FS 591 Special Problems in Food Science. Preq: Grad. or sr. standing. Maximum 6 F,S,Sum. Analysis of scientific, engineering and economic problems of current interest in foods. The problems are designed to provide training and experience in research. Graduate Staff

GENETICS

GN 301 Genetics in Human Affairs. Students should have sophomore standing. 3(3-0) F,S. Fundamental principles of genetics presented at a level not requiring courses in biological sciences but sufficient for understanding the relation of genetics to society and technology. A survey of current knowledge of inheritance of human traits. McKenzie

GN 411 The Principles of Genetics. Preq: BS 100, Jr. standing. 3(3-0) F,S. An introductory course. The physical and chemical basis of inheritance; genes as functional and structural units of heredity and development; qualitative and quantitative aspects of genetics variation. Bewley, Schaffer

GN 412 Elementary Genetics Laboratory. Preq. or Coreq: GN 411. 1(0-2) F,S. Experiments and demonstrations provide an opportunity for practical experience in crossing and classifying a variety of genetic materials, particularly *Drosophila*.

Schaffer, Graduate Assistants

Selected 500-Level Courses Open To Advanced Undergraduates

GN 504 Human Genetics. Preq: GN 301 or 411, or equivalent. 3(3 0) S. The basic principles needed for an understanding of the genetics of man. Current knowledge and important areas of research in human genetics.

McKenzie, Schaffer

GN 505A,B,C,D Genetics I. Preq: GN 411 or its equivalent. 1-4 F. Lectures in genetic principles presented as a series of five-week minicourses: GN 505A, qualitative genetics; GN 505B, microbial and biochemical genetics; GN 505C, cytogenetics. The laboratory, GN 505D, will involve experimental techniques in genetics and will extend throughout the semester. Majors and minors must enroll for the entire series. Others may enroll for specific minicourses and attend first lecture of semester for schedule.

Grosch, Gerstel, Kloos

GN 506A,B,C,D. Genetics II. Preq: GN 411 or its equivalent. 1-4 S. Lectures in genetic principles presented as a series of five-week minicourses: GN 506A, developmental genetics; GN 506B, quantitative genetics; GN 506C, population genetics. The laboratory, GN 506D, will involve experimental techniques in genetics and will extend throughout the semester. Majors and minors must enroll for the entire series. Others may enroll for specific minicourses and attend first lecture of semester for schedule.

Scandalios, Moll, Ahlberg

GN (ANS) 508 Genetics of Animal Improvement. 3(3-0) S. (See animal science.)

GN (PO) 520 Poultry Breeding. 3(2 2) S. (See poultry science.)

GN (ZO) 532 Biological Effects of Radiations. Preq: BS 100, or GN 301, or CI. 3(3-0) S. Qualitative and quantitative effects of radiations (other than the visible spectrum) on biological systems, to include both morphological and physiological aspects in a consideration of genetics, cytology, histology, and morphogenesis.

Grosch

GN (ZO) 540 Evolution. Preq: Nine credits in biological sciences. 3(3-0) F. The facts and theories of evolution in plants and animals. The causes and consequences of organic diversity.

Staff

GN (CS, HS) 541 Plant Breeding Methods. 3(3-0) F. (See crop science.)

GN (CS, HS) 542 Plant Breeding Field Procedures. 2(0-4) Sum. (See crop science.)

GN (CS) 545 Origin and Evolution of Cultivated Plants. 2(2-0) S. (See crop science.)

GN (ZO) 550 Experimental Evolution. Preq: GN 506, or CI. 3(3-0) F. A survey of studies on experimental and natural populations of plants, animals, and man in relation to the theoretical aspects of evolution and speciation; a descriptive rather than rigorous mathematical review. (Offered 1978-79 and alt. yrs.)

Laurie-Ahlberg

GN 560 Molecular Genetics. Preqs: GN 411; BCH 351. 3(3 0) F. A discussion of the structure and function of the genetic material at a molecular level. Both prokaryotic and eukaryotic systems will be considered. The aim will be to describe genetics in terms of chemical principles. (Offered 1978-79 and alt. yrs.)

Flashman

GN (BCH, MB) 561 Biochemical and Microbial Genetics. Preqs: BCH 351 or 551, GN 411 or 505, MB 401 or equivalent. 3(3 0) S. The course will include the development of the fields of biochemical and microbial genetics and will emphasize both the techniques and concepts utilized in current research.

Armstrong

GREEK LANGUAGE AND LITERATURE

GRK 101 Elementary Greek I. 3(3 0) F. Introduction to Classical Greek. A study of the Greek alphabet, three declensions, conjugation of regular and some irregular verbs. Readings based on Greek mythology, philosophy and literature.

GRK 102 Elementary Greek II. Preq: GRK 101. 3(3-0) S. After a brief review of conjugations and declensions, this course takes up the study of the middle voice, uses of optative and subjunctive, infinitive, aorist, future tenses and genitives, plus other syntactical and morphological phenomena. Readings from Plato, the New Testament, Xenophon, Herodotus.

GRK 201 Intermediate Greek I. Preq: GRK 102. 3(3-0) F. An introduction to Greek prose, with emphasis on increasing reading skill through vocabulary acquisition and the study of complex grammatical structures. Plato's *Apology*, *Crito*, and selections from the *Phaedo* are read. The relationship of the Platonic writings to other Greek literature is examined through reading in translation selections from the Greek orators, historians, poets, and playwrights.

GRK 202 Intermediate Greek II. Preq: GRK 201. 3(3-0) S. A study of the techniques of oral poetry, the use of myth, and the literary and historical significance of Homer's *Iliad* and the New Testament. An analysis of differences between classical and Koine Greek.

GRK 310 Classical Mythology. 3(3-0) F. An introduction to 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. Examination of the 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) S. A study of the tragedies of Aeschylus, Sophocles, and Euripides in translation. Discussions of the literary and social aspects of the individual plays and of the tragic genre in the fifth century. Examination of selections in Aristophanes, Plato, Aristotle and Seneca which discuss or reflect Greek tragedy.

GEOLOGY

GY 101 General Physical Geology. Credit may not be obtained for both GY 101 and 120. 3(3 0) F,S. 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. Recommended that GY 110 be taken concurrently. Staff

GY 110 Physical Geology Laboratory. Coreq: GY 101 or 120. 1(0-2) F,S. The common rock forming minerals, the common rocks, topographic maps, geological structures and geological maps. Field trips.

GY 120 Elements of Physical Geology. Credit may not be obtained for both GY 101 and 120. 2(2-0) F,S. Basic principles of physical geology. Major earth processes, principal geologic features, earth materials, and their interrelationships. Primarily intended for majors in disciplines requiring a minimum practical working knowledge of geology. Recommended that GY 110 be taken concurrently.

GY 201 Historical Geology. Preqs: GY 101 or GY 120. 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 past 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. Recommended that GY 210 be taken concurrently. Harrington

GY 208 Environmental Physical Geography. 3(3-0) F,S. Study of man's physical environment and his relation to it. Topics include atmospheric and oceanic structure and circulation; weather and climate; soils and landforms; volcano and earthquake hazards; interaction of air, sea and land; interaction of man and his environment; air and water pollution.

GY 210 Historical Geology Laboratory. Coreq: GY 201. 1(0-2) S. The reconstruction and interpretation of past events in the history of the earth. Interpretation of sedimentary rocks, construction and interpretation of geological maps, the identification of fossil organisms and the utilization of fossils in the reconstruction of earth history. Harrington

GY 330 Crystallography and Mineralogy. Coreq: GY 101 or 120. 3(2-3) F. The elements of morphological crystallography. Space lattices, crystal symmetry, systems and classes. Stereographic projection of common forms. Identification of minerals by crystallographic

features, cleavage, fracture, luster, color, streak, hardness, specific gravity, etc. Chemical composition, varieties, occurrence, association, important localities and uses. Crystal structures of selected minerals. Stoddard

GY 331 Optical Mineralogy and X-Ray Diffraction. Preq: GY 330 4(2-4) S. Techniques and underlying optical theory for identifying minerals with the polarizing microscope. Determination of index of refraction and birefringence; isotropic, uniaxial or biaxial character, optical sign and orientation. Adjunct apparatus for statistical and petrographic studies. Generation of x-rays, techniques and underlying theory for identifying by x-ray diffraction. Stoddard

GY 351 Structural Geology. Preq: GY 201 and 330. 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. Field trips. Aldrich

GY 400 Environmental Geology. Preq: GY 101 or 120. 3(2-1) S. Man's effect upon and interaction with such processes as mass-wasting soil development, erosion, transport and deposition of sediments, surface waters, groundwater, volcanism and earthquakes. Environmental aspects of mineral and petroleum usage and waste disposal as affected by geologic processes and materials. Welby

GY 415 Geology of Metalliferous Deposits. Preqs: GY 440, GY 452. 3(2-3) S. The nature, geologic setting and geographic distribution of metallic mineral deposits. Emphasis is on those deposits yielding ferrous, base, and precious metals and on the various geologic processes that work to produce them. Laboratory work with ore suites from famous mining districts of the world. Field Trips. Brown

GY 423 Invertebrate Paleontology and Biostratigraphy Preqs: GY 201-210, or ZO 202. 4(3-3) F. Study of invertebrate forms occurring commonly as fossils together with study of their application to problems of correlation of strata, paleoecology, and development of concepts of evolution. Lecture, laboratory, field trips. Welby

GY 440 Igneous and Metamorphic Petrology. Preq: GY 331. 4(3-3) F. Rocks that are formed at high temperatures and pressures by crystallization or solidification of molten magma or by solid-state recrystallization of older rocks. Application of principles of phase-rule chemistry, and of the results of modern high pressure-temperature laboratory research on the stability fields of crystalline phases to an understanding of igneous and metamorphic rocks. Identification, classification, occurrence, and origin of the principal igneous and metamorphic rocks. Fodor

GY 452 Sedimentary Petrology and Stratigraphy Coreq: GY 331. 4(3-3) S. Identification, classification, geologic occurrences, and origin of minerals, rocks and mineral deposits formed by physical, chemical and biological processes at low temperatures and pressures at and near the earth's surface. Principles of divisions of stratified terrains into natural units, correlation of strata, identification of depositional environments, and facies analysis. Cavaroe

GY 461 Engineering Geology. Preq: GY 101 or 120. 3(3-0) F. Applying geologic principles to engineering practice; analysis of geologic factors and processes affecting specific engineering projects. (Offered F 1979 and alt. years.) Leith

GY 462 Field Geology. Preq: GY 351. 3(1-5) F. Methods of collecting geologic data and samples in the field. Introduction to the use of geologic surveying instruments. Basic geologic mapping. Preparation of geologic maps, cross sections, and geologic reports. Aldrich

GY 465 Geologic Field Camp. Preq: GY 351, 440, 452. 6. Sum. Six weeks summer field course. Field procedures and geologic instruments. Geological mapping of various geologic structures and terrains. Field trips. Aldrich

GY 470 Principles of Geophysics. Preqs: PY 208 or 212; GY 120 or equivalent recom mended. 3(3-0) F. The structure of the earth as inferred from geophysical investigations of gravity, earth magnetism, earthquake seismology, thermal history, and geodynamics. Data acquisition and interpretation. Applications to exploring natural resources and to engineering geology. Won

GY 481 Principles of Geomorphology. Preq: GY 201 or equivalent. 3(2-2) F. Land forms, the processes responsible for their origin, their stages of development and the underlying geology and structures on which they have formed. Emphasis on the geologic principles involved in interpreting the origin and evolution of the North American landscape.

Harrington

GY 491 Seminar on Selected Geologic Topics. 1.3. Study and discussion of selected geological topics.

Selected 500-Level Courses Open To Advanced Undergraduates

GY 500 Regional Geology of North America. Preqs: GY 101 or 120, sr. standing. 1-6. Field study of classic geologic localities and geomorphic processes not indigenous to North Carolina. Typical areas are New England and adjacent Canada, northern Mexico and southwestern United States, and the Pacific Northwest. Representative subjects include the Canadian Shield, Precambrian mineral deposits, the San Andreas fault, desert geomorphology, Grand Canyon stratigraphy, modern and ancient reefs, and glaciated volcanoes. Mineral, rock, and fossil collecting. Student reports required.

Graduate Staff

GY 521 Introduction to Subsurface Well Evaluation. Preqs: CH 103, PY 212, GY 120. 3(2-3) Alt. F. Principles, uses and interpretation of commonly used wireline technique for structural, lithologic, and fluid evaluation of wells. Oriented towards petroleum reserve/evaluations.

Cavaroc

GY 522 Petroleum Geology. Preq: GY 452. 3(3-0) S. Properties, origin, and modes of occurrence of petroleum and natural gas. Geologic and economic features of the principal oil and gas fields, mainly in the United States. (Offered S 1980 and alt. yrs.)

Leith

GY 524 Continental Evolution. Preqs: GY 222, 351, 440, 452. 3(3-0) F. The stratigraphic and tectonic events which have shaped the continents, with emphasis upon North America; field trips. (Offered F 1980 and alt. years)

Welby

GY 532 Ore Microscopy. Preq: GY 331. 3(0-6) F. The theory and technique of microscopic investigation of opaque ore minerals, ores and mill products produced by beneficiation of ores. Studies of compositions and textures of materials in polished surfaces are based on observations of optical and physical properties, etch reactions and microchemical tests. (Offered F 1979 and alt. years.)

Brown

GY 542 Intermediate Petrographic Analysis. Preq: GY 440 or equivalent. 2(0-5) F. Systematic study of rocks in thin section by means of the petrographic microscope. Mineralogy, mineral and rock compositions, and rock textures applied to an interpretation of the origin and crystallization or depositional history of specimens studied. Suites representative of each of the three major rock groups will be studied during the first half of the semester; during the remainder of the semester, the student will concentrate on suites representative of his/her area of specialization.

Stoddard, Cavaroc

GY 545 Advanced Igneous Petrology. Preq: GY 440. 3(2-2) S. Physicochemical principles related to igneous petrogenesis. General principles and specific problems including the origin, differentiation and emplacement of magmas and the possible relationships of igneous processes to global tectonics. (Offered S 1980 and alt. years.)

Fodor

GY 546 Advanced Metamorphic Petrology. Preq: GY 440. 3(2-2) Alt. S. The petrogenesis of metamorphic rocks including conditions of metamorphism, metamorphic facies and facies series, the petrogenetic grid, contact and regional metamorphism, metamorphism and plate tectonics. Heterogeneous chemical equilibrium and application of Gibbs Phase Rule to metamorphic rocks. Thermodynamically valid algebraic and graphical analysis of equilibrium mineral assemblages. Chemical zoning. Petrographic studies of selected metamorphic suites. (Offered S 1979 and alt. yrs.)

Stoddard

GY 551 Advanced Structural Geology. Preq: GY 351. 3(2-3) Alt. F. Principles of rock mechanics and their application in solving geologic problems; finite strain analysis of deformed rocks; advanced techniques of structural analysis; petrofabrics; development of various geologic structures. Course is designed to emphasize the application of principles and techniques in the field.

Aldrich

- GY 563 Applied Sedimentary Analysis.** Preqs: GY 452, ST 361. 3(2-2) F. Extension of GY 452, with emphasis on coarser grained elastic sedimentary rocks. Sampling of sedimentary population, critical study of assumptions underlying standard measurement techniques; treatment, testing and evaluation of sedimentary data; application to problems in sedimentology. (Offered F 1980 and alt. yrs.) Cavaroc
- GY 564 Depositional Environments and Lithostratigraphy.** Preq: GY 452 or grad. standing. 3(2-3) S. Fabric of large sedimentary basins in terms of the spatial distribution of component major rock facies; current litho-genetic models based upon comparison with recent equivalents; field trips. Cavaroc
- GY 565 Hydrogeology.** Preq: GY 452. 3(3-0) S. Occurrence and sources of surface and subsurface water. Relationships of surface water to subsurface water. Rock properties affecting infiltration, movement, lateral and vertical distribution, and quality of ground water. Determination of permeability, capacity, specific yield, and other hydraulic characteristics of aquifers. Principles of well design, legal aspects of water supplies. (Offered S 1981 and alt. yrs.) Welby
- GY 567 Geochemistry.** Preq: CH 331 or 433. 3(3-0) F. The quantitative distribution of elements in the earth's crust, the hydrosphere and the atmosphere. Application of the laws of chemical equilibrium and resultant chemical reactions to natural earth systems. Geochemical application of Eh-pH diagrams. Geochemical cycles. Isotope geochemistry. (Offered F 1980 and alt. years.) Graduate Staff
- GY 570 Exploration and Engineering Geophysics.** Preq: GY 470 or PY 207 or PY 208 or equivalent. 3(3-0) S. 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. Won
- GY 571 Geophysical Field Methods.** Preq: GY 570. 2(2-week summer camp) Sum. Two-week summer field course. 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 are required to register for the course in the second summer session. Location: within the state of North Carolina; estimated expense: \$150. (Offered Sum. 1979 and alt. yrs.) Won
- GY 581 Geomorphology.** Preqs: GY 101 or 120 plus appropriate background. 3(2-3) F. Land forms and their relations to processes, stages of development, and adjustments of structure. Emphasis on mass-wasting, fluvial geomorphology of humid and arid climates, coasts, karst and eolian processes. Lectures, map interpretations and field trips. Harrington
- GY 582 Quaternary Geology.** Preqs: GY 101 or 120, sr. standing. 3(3-0) S. Glaciology, glacial geology, Pleistocene stratigraphy, periglacial geomorphology; Quaternary volcanism, tectonism, and sea-level fluctuations; late Cenozoic climate changes; field trips. (Offered S 1981 and alt. yrs.) Harrington
- GY 583 Photogeology.** Preq: GY 101 or 120. 3(2-2) S. The stereoscopic study of aerial photographs to obtain geologic information. The construction of bedrock and surficial geologic maps from aerial photographs. Aspects of remote sensing useful in geologic interpretation. Harrington
- GY (MSE) 584 Marine Geology.** Preqs: GY 452, or 101 or 120 plus appropriate background. 3(3-0) S. Morphology, structure and origin of ocean basins with their diverse features and their relations to the continents. Physical and chemical properties of the oceans, sedimentation in the marine environment and near-shore features. The economic potential of mineral resources derived from oceanic areas. (Offered S 1980 and alt. yrs.) Nittrouer
- GY 588 Regional Tectonics.** Preqs: GY 351, 440, 452. 3(3-0) S. 1980 and alt. yrs. Methods of study of the tectonic history of major geologic regions in North America and other areas of the world through the application of stratigraphy, petrology, and structural geology. Synthesizing regional tectonic patterns and events. Aldrich
- GY 593 Advanced Topics in Geology.** Preq: CI. 1-6 F,S. Special study of some advanced phases of geology. Graduate Staff

HISTORY OF ART

HA 201 History of Art From Ancient Greece Through the Renaissance. 3(3-0) F,S. A survey of art from Ancient Greece and Rome through the Italian Renaissance covering the major art forms of painting, sculpture, and architecture. Includes the early medieval period as well as the later developments of the Romanesque and Gothic eras. Ketchiff

HA 202 History of Art From the Renaissance Through the 20th Century. 3(3-0) F,S. A survey of art from the Northern Renaissance in Europe through the 20th century in Europe and America. Painting, sculpture and architecture are examined as well as the more recent techniques of collage, frottage and other mixed media approaches. Ketchiff

HA 203 History of American Art. 3(3-0) S. Alt. yrs. A history of American Art (painting, sculpture and architecture) from the Colonial Period through the 20th century. Ketchiff

HA 298 Special Topics in Art History. 3(3-0). Introductory survey of particular areas of art history. Special topics will vary semester to semester, but emphasis will be on chronological periods such as 20th century art, the Italian Renaissance, etc. Ketchiff

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 The Ancient World to 180 A.D. 3(3-0) F,S. The ancient cultures of the Middle East and Graeco-Roman civilization, including Egyptian, Minoan, Mycenaean, 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, and the political, economic, and social institutions of the High Middle Ages.

HI 209 Renaissance to Waterloo 1300-1815. 3(3-0) F,S. A survey of all aspects of the period of transition from the medieval to the modern world. Includes the decline of medieval institutions, the Renaissance, the Reformation and Counter-Reformation, rise of Absolutism, the English 17th-century revolution, the French Revolution and Napoleonic era.

HI 210 Modern Europe 1815-Present. 3(3-0) F,S. An introductory 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; the 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. Major attention to Mexico, Argentina, Brazil, Peru, and Cuba. Topics include the social structure of the new nations; 19th century liberalism; the force of tradition; relations with Europe and the United States; the Monroe Doctrine and U.S. intervention; economic change; caudillo rule; 20th century upheavals; the Mexican Revolution; Peron's Argentina; Castro and Latin America.

HI 221 An Introduction to British History to 1688. 3(3-0) F,S. A general survey of the history of British society, culture, and politics to 1688.

HI 222 An Introduction to British History Since 1688. 3(3-0) F,S. A general survey of the history of British society, culture, and politics since 1688.

HI 233 The World in the 20th Century. 3(3-0) F,S. National and international problems in the Western and non-Western world, including institutions and ideas at the turn of the cen-

ture, origins and effects of the First World War, the post-war challenge to Western democratic supremacy from within and without, the Second World War, and problems of the post-war period.

HI 241 United States to 1783. 3(3-0) F,S. The European background of American history; establishment of English colonies in America; colonial historical development; the conflict with England, the securing of independence, and the establishment of independent government.

HI 242 United States, 1783-1845. 3(3-0) F,S. Inauguration of the new nation; territorial expansion and the westward movement; growth of democracy and social reform; development of national feeling and sectional tensions.

HI 243 United States, 1845-1914. 3(3-0) F,S. The coming of the Civil War; the war and the reconstruction of the nation; the rise of industrialism and the Populist and Progressive response; the emergence of the United States as a world power.

HI 244 United States Since 1914. 3(3-0) F,S. The United States and the First World War; the society in the 1920's; the Great Depression and the New Deal; the Second World War and post-war international problems; the Truman and Eisenhower years; America in the 1960's and 1970's.

HI 263 Traditional East Asia: Prehistory to 1800. 3(3-0). Introduction to the civilizations of China, Japan, and Korea prior to the penetration of Western institutions and ideas.

HI 264 Modern East Asia: 1800 to Present. 3(3-0). The western impact and the responses in China, Japan, and the smaller nations of East and Southeast Asia.

HI 275 Introduction to History of South and East Africa. 3(3-0) F,S. The history of Southern and Eastern Africa, focusing on such topics as the African kingdoms (the Lunda, Buganda and Zulu kingdoms); 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, focusing on such topics as the forest civilizations and the slave trade, the trade and the expansion of Islam, the colonialism in West Africa, the emergence of African nationalism and the achievement of independence, and post colonial West Africa.

HI 298 Special Projects in History. 1-3 F,S. Utilized for guided research or experimental classes at the soph. level. Staff

HI 315 History of the Crusades: Conflict and Culture in the Mediterranean. 3(3-0) Alt. yrs. The causes and deeds of the long conflict over the Holy Land during the Middle Ages, known as the Crusades, and the concurrent cultural interchanges and economic, social, political and legal relations between Classical Islamic and Western Medieval European civilizations. Readings are given in translated Arabic, Latin, Hebrew and Greek sources as well as secondary authors. Lectures are given from both the Western and Eastern perspectives. Newby, Riddle

HI 321 Ancient and Medieval Science. 3(3-0) F. Selected topics to examine how pre-modern "science" differed from the science that emerged after the "Scientific Revolution" of the 17th century. The relations of science to social and economic factors, technology, magic, and religion. Examples from pre-history, Mesopotamia, Egypt, China, India, Greece, Rome, Islam and the Medieval and Renaissance West. Sylla

HI 322 Rise of Modern Science. 3(3-0) F,S. The "Scientific Revolution" of the 16th and 17th centuries. Analysis of Newton's System. The origins of modern chemistry, geology and evolution theory. The radical revision of Newtonian theory in the 20th century. These developments are considered within the context of the great historical movements of their time. Mulholland, Sylla

HI 333 History of American Sport. 3(3-0). An examination of sports as a reflection of and a factor within the general development of American history. Beezley, Hobbs

HI 341 Technology in History. 3(3-0) S. The role of technology in society from earliest times to the present. The achievements of technology and their impact on society as a whole

are examined along with the social status, education, sources of support, and relationships to church and government of scientists and engineers in various periods. Mulholland

HI 343 U. S. Urban History, 1607-Present. 3(3-0) F. An introductory survey of U.S. urban history, 1607 present. Major emphasis on the historical background of today's social, economic, and political urban problems. Research projects tailored to fit the interest and career plans of individual students will be required. King

HI 348 History of Women in the United States. 3(3-0). The history of women's roles as they relate to economic and social change in the United States. The lives of women in pre-industrial and industrial America with focus on women's experiences in both the public sphere (politics and reform for example) and the private sphere (domestic, reproductive, and family patterns). O'Brien, Scott

HI 365 The American West. 3(3-0) F. A history of the American frontier with emphasis on the trans-Mississippi West. The course surveys the cycles of exploration, conquest, and exploitation of this region, and examines the influence of the frontier in the development of the United States. Crisp

HI (EB) 370 The Rise of Industrialism. Preq: EB 201 or 212. 3(3-0) F. (See economics and business.)

HI (EB) 371 Evolution of the American Economy. Preq: EB 201 or 212. 3(3-0) F. (See economics and business.)

HI 372 Afro-American History Through the Civil War, 1619-1865. 3(3-0). After a brief consideration of their African background, the course considers the particular role, experience and influence of Afro-Americans in the United States through the Civil War. Staff

HI 373 Afro-American History Since 1865. 3(3-0). The history of Afro Americans in the United States from the Reconstruction era through the Civil Rights Movement or Black Revolution of the 1950s and 1960s. Staff

NOTE: Prerequisite for 300 level courses: Three hours of history.

HI 400 Civilization of the Ancient Near East. 3(3-0). 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). The history of the Hellenes from the Minoan civilization through Alexander's legacy, with readings in Herodotus and Thucydides. Sack

HI 404 Rome to 180 A.D. 3(3-0). Roman development from the Etruscans through Emperor Marcus Aurelius (180 A.D.). Examines through readings in Livy and Tacitus the great political achievement which saw Rome rise from a cattletown on the Tiber to the head of an Empire. Riddle

HI 406 From Roman Empire to Middle Ages. 3(3-0). Using primarily translated Latin sources the course deals with decline of Imperial Rome, and its succession by new Christian, Germanic, and Islamic civilizations. Newby, Riddle

HI 407 Islamic History to the Crusades. 3(3-0). The history of the Islamic Near East to the disintegration of the Caliphate and the beginning of the Crusades. Topics will include: The East Mediterranean and Arabia before Islam, Muhammad and the development of Islam, the early Caliphates, the Abbasid revolution, sources of Muslim civilization, the Classical heritage and Islam, Islamic society and institutions, Islamic law, Islamic mysticism. Newby

HI 408 Islamic History from the Crusades to 1798. 3(3-0). The history of the Islamic world from the Crusades to 1798. Topics will include: The Crusades and the Counter Crusades; the Ottomans; Islamic literature, science, philosophy, art and architecture; Islam in Spain, India, Asia and Africa; the rise of European influence. Newby

HI 410 Italian Renaissance. 3(3-0). Renaissance humanism, an educational ideal and an awareness of man as the sole creator in the historical world, will be examined in its relationship to the Italian republics and princedoms of the 14th through the 16th century. Banker

- HI 411 The Protestant and Catholic Reformation of the 16th Century.** 3(3-0). The conditions and criticisms which lead 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
- HI 414 The Age of Absolutism.** 3(3-0). Concentrates on the development of royal absolutism in 17th century Europe, the nature of the institutions which supported it, the particular cultural forms and patterns which it generated, and the reasons for its decline in the 18th century.
Greenlaw
- HI 415 Revolutionary Europe.** 3(3-0). A broadly based analysis of Europe's first revolutionary era. The revolution in thought called the Enlightenment, the causes and character of the Revolution in France, the impact of these events in France and Europe.
Greenlaw
- HI 416 European Life and Work, 1750-1850.** 3(3-0). An historical examination of social traditions and change in Europe (esp. England, France and Germany) from the mid-18th to the mid-19th century, including both rural and urban life. The course emphasizes population growth and its effects, changes in lower and middle class family life, the evolution of labor, the experience and perception of poverty, and types of popular protest. LaVopa
- HI 418 Fascism in Germany and Italy, 1919-1945.** 3(3 0). Hitler and Mussolini: two aspects of European Fascism in the interwar period.
Suval
- HI 424 England From the Celts to 1485.** 3(3-0) S. A political history of England from the Celts to 1485 with special emphasis upon political and religious ideas and institutions and the development of the English Constitution.
Downs
- HI 425 Tudor and Stuart England.** 3(3-0). The permanent political crisis set into motion by the Reformation culminating in the English Civil War. Emphasis on certain key developments in social, political and economic life such as 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 426 England in the 18th and 19th Centuries.** 3(3 0). A political history of England during the 18th and 19th centuries with special emphasis upon political ideas and institutions and constitutional developments as viewed within the context of social and intellectual change.
Downs
- HI 429 20th Century Britain.** 3(3-0). British political, social and economic history since 1914, with reference to the effects of two world wars, the growth of the Welfare State, British decline as a power, and the search for a new role in the world.
Carlton
- HI 430 Modern France.** 3(3-0). The major trends since the downfall of Napoleon I with a short preliminary survey of the old regime and the revolutionary period 1789-1815. Cultural, economic, social and intellectual trends are stressed as well as the political. The ways in which France has been a seedbed for new movements in Europe.
Brown
- HI 431 Germany: Luther to Bismarck 1500-1871.** 3(3-0). A history of Germany from the Reformation to the completion of national unification in 1871, including the major historical events and personalities and emphasizing the impact of socio-economic changes on politics and culture.
LaVopa
- HI 432 History of Germany Since 1871.** 3(3 0). German history from the unification of 1871 to the present, concentrating on problems of nationalism and political and social reform.
Suval
- HI 436 European Thought and Society, 1750-1900.** 3(3-0). A study of major figures in European thought and letters since the Enlightenment and their influence on European and World culture, society and politics.
Staff
- HI 438 History of Russia to 1881.** 3(3 0). The social, political, economic and cultural history of Kievan Russia, Muscovy and Imperial Russia through the emancipation of the serfs and the fundamental reforms that followed. Emphasis on internal developments; some attention to foreign policy.
Wheeler

- HI 439 History of Russia Since 1881.** 3(3-0). The history of Russia and the Soviet Union from the great reforms of the 19th century to modern times emphasizing political, religious, and cultural trends that underlie the development of the Russian state and society and the position of the U.S.S.R. in the world today. Some attention to foreign policy with emphasis on Soviet period. Wheeler
- HI 441 The United States: The Colonial Period.** 3(3-0). An intensive analysis of the English Colonization of the New World, the motives for settlement, the growth of political institutions, the development of imperial-colonial relations, the rise of slavery, the role of religion and ideas in colonial life, and the process of Americanization from 1606 to 1763. Constantin
- HI 442 The United States: Revolution to Constitution.** 3(3-0). The conflict with Great Britain after 1763 leading to the declaring of independence; the war for American independence; the political, social, and ideological problems in establishing the government of the new nation. Constantin
- HI 443 The Age of Jefferson.** 3(3-0). The political, social, economic, intellectual and diplomatic aspects of United States history from the adoption of the Constitution in 1789 through the second Madison administration. Establishment of the federal government; implementation of Hamilton's financial system; foreign affairs during the Wars of the French Revolution; rise of political parties; triumph of the Jeffersonian Republicans; territorial expansion of the United States; War of 1812. Wishy
- HI 444 The Age of Jackson, 1815-1850.** 3(3-0). The major political, social, cultural and economic developments from the Era of Good Feelings to the Compromise of 1850. Readings organized around four major interpretations of the period. King
- HI 445 American Social Ideals and Institutions Before the Civil War.** 3(3-0). Investigation in selected periods before the Civil War of the structure and role of the American family, organization of voluntary societies (such as reform groups) of professions and occupations and the development of social ideals and attitudes in both workaday and highbrow culture. Readings include diaries, letters and advice manuals. Scott
- HI 446 Civil War and Reconstruction.** 3(3-0). The period of sectional strife and war. Examination of the impact of the war on the United States and the efforts to reconstruct the South on a national basis. Harris
- HI 447 American Social Ideals and Institutions Since the Civil War.** 3(3-0). Study of American social and cultural life since the Civil War and focusing on changes in the nature of social ties, in the institutions surrounding work, in sex roles and the function of the family, and in agencies of education and communication. Scott
- HI 450 The United States in Prosperity and Depression, 1919-1939.** 3(3-0). The domestic history of the United States between the World Wars, emphasizing the social and political responses to economic, demographic, and organizational change. Collins
- HI 452 Recent America.** 3(3-0). Some of the major problems in American life since 1939. Hobbs
- HI 454 U.S. Foreign Relations.** 3(3-0). The origins of American foreign policy and the conduct of diplomacy in the era since the United States became a world power. Stresses complex array of personalities, ideas, institutions and forces involved in shaping and implementing policy. Beers
- HI 455 Christianity and Its Critics in American History.** 3(3-0). Analysis of major challenges to conventional or established belief and orthodoxy from Anne Hutchinson and Roger Williams to the age of Darwin. Concentration on the major intellectual debates about the foundations of traditional faith as well as on alternatives to Christianity and attempts to restate its claims. Constantin
- HI 458 Significant Figures in 20th Century America.** 3(3-0). The impact on American life in the 20th century of some important people in the fields of politics, war and peace, sports and various forms of communication. Hobbs
- HI 461 Civilization of the Old South.** 3(3-0). 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 Negro slavery, Southern social order, intellectual and cultural life, economic development, and rise of Southern nationalism. Crisp, Elliott

HI 462 The New South in America. 3(3-0). A brief investigation of distinguishing features of Southern society on the eve of the Civil War and extended analysis of the subsequent development of this society in a modernizing nation. O'Brien

HI 463 North Carolina to 1860. 3(3-0). North Carolina history from the earliest explorations through the 1850's. Elliott

HI 464 North Carolina Since 1860. 3(3-0). North Carolina history from the eve of the Civil War to the present. O'Brien

HI 467 Modern Mexico. 3(3-0) F. 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 20th Century Latin American Revolutions. 3(3-0). The variety of revolutionary changes in certain 20th century Latin American republics. Concentrates on Argentina, Bolivia, Peru, and Cuba, but includes some other nations. Examines movements dedicated to the overthrow of traditional liberal institutions and their replacement by other political, social, and economic systems. Beezley

HI 471 Revolutionary China. 3(3-0). The failure of traditional Chinese society to find means of accommodation with the West. The emergence of the revolutionary Communist state and society. Ocko

HI 472 Modern Japan, 1850 to Present. 3(3-0). Japan's emergence as a nation and world power. Ocko

HI 473 20th Century Asian Revolutionaries. 3(3-0). Use of psycho historical techniques for the comparative study of the lives and works of great figures in 20th century Asia: Sun Yat-sen, Mao Tse-tung, Mohandas Gandhi and Jawaharlal Nehru. Ocko

HI 475 History of the Republic of South Africa: Race, Class, and Politics in Historical Perspective. 3(3 0). The evolution of South Africa's plural society, with emphasis on the interaction of diverse peoples and cultures. Particular attention is given to the period marked by rapid economic growth since 1870. Vickery

HI 491 Seminar in History. Open to juniors and seniors in history and to other juniors, seniors and graduate students with departmental permission. 3(3-0) F,S. Topics vary each semester. Consult history department for specific topics. Staff

HI 498 Special Topics in History. 1 6 F,S. Extensive readings on predetermined topics focused around a central theme. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

NOTE: Prerequisite for all history courses at the 500 and 600 level is six hours of advanced history or equivalent.

HI 515 The High Middle Ages. 3(3-0). An analysis of medieval culture. Topics such as the revival of the Roman Empire, monastic and papal reform, the rise of universities, the evolution of representative bodies, the Gothic style, troubadour and goliardic poetry, scholasticism, and the revival of Roman law. Riddle

HI 528 England in the Age of the American Revolution. 3(3-0). An intensive study of English political, religious, economic, social, and imperial ideas and institutions between 1763 and 1783 with special emphasis on how these affected and were affected by the War of the American Revolution. Downs

HI 530 Era of the French Revolution and Napoleon. 3(3-0). Aspects of the French Revolution and the Napoleonic era which are currently subject to differing interpretations. Greenlaw

- HI 532 History of Great Britain, 1820-1914.** 3(3-0). Great Britain from the Regency of George IV to the outbreak of World War I with emphasis on the most significant developments in constitutional, religious, and economic ideas and institutions. Downs
- HI 536 History of International Relations Since 1870.** 3(3-0). European diplomatic history and world international relations from the Franco-Prussian war through both World Wars up to the present. Emphasis on policies and attempts to solve international problems. Brown
- HI 545 The American Civil War.** 3(3-0) F. Events that led to the disruption of the union and an intensive study of the war, emphasizing nonmilitary aspects. Only the major military campaigns are discussed. Harris
- HI 546 Reconstruction of the American Union.** 3(3-0) S. The difficulties involved in the restoration and readjustment of American society after the Civil War. Attention to social and economic conditions in the defeated South, military reconstruction and Republican ascendancy in the region. Harris
- HI 548 The American Response to Industrialism.** 3(3-0). The industrialization of the American economy and efforts to deal with the ensuing transformation of American life through politics, social institutions and ideas. O'Brien
- HI 551 History and Principles of the Administration of Archives and Manuscripts.** 3(3-0) F. The nature, importance and use of original manuscript resources; the history and evolution of written records, and the institutions administering them. Mitchell
- HI 552 Application of Principles of Administration of Archives and Manuscripts.** Preq: HI 551. 3(3-0) S. Internship training applies the principles and practices of archival management. Mitchell
- HI 561 U.S. Far Eastern Relations.** 3(3-0). American expansion into the Pacific and involvement in Asian affairs. Both official diplomatic relations and unofficial contacts (by missionaries, educators, businessmen, and the like) which influenced Americans. Beers
- HI 565 The History of Urban Life in the U.S., 1607-1865.** 3(3-0) F. Designed to give the student an understanding of the historical background of today's urban problems. King
- HI 566 The History of Urban Life in the U.S., 1865-Present.** 3(3-0) S. Designed to give the student an understanding of the historical background of today's urban problems. King
- HI 572 History of Soviet Russia Since 1930.** 3(3 0). Analysis of the domestic and foreign policies of the Soviet Union since 1930 with emphasis on the position of the Soviet Union in the world since 1945. Wheeler
- HI 598 Special Topics in History.** 1-6 F,S. An investigation of topics of particular interest to advanced students under the direction of faculty members on a tutorial basis. Graduate Staff

HORTICULTURAL SCIENCE

- HS 101 Plants for Home and Pleasure.** 3(2-3) F,S. A general course concerned with the basic uses of plants and flowers in and around the home. Topics studied will be indoor plants, flower arranging, home landscaping, and flower, vegetable and fruit gardening. Staff
- 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. Fonteno
- HS 211, 212 Ornamental Plants.** Preq: BS 100. 3(1-5) F (211), S (212). Identification, distribution, growth characteristics, adaptation, and usage of ornamental trees, shrubs, vines, and herbaceous plants in the landscape. Southall
- HS 301 Plant Propagation.** Preq: BS 100, or BO 200. 3(2 2) F,S. The principles, methods, and practices in seedage, cuttage, division, budding, grafting, and other methods of propaga-

- tion. Influence of hereditary, environmental, and pathological variations on the plant products. Staff
- HS 342 Landscape Horticulture.** 3(2-3) F,S. Application of design principles to landscaping small properties and selecting and planting trees, shrubs, flowers, and lawn grasses. Students will work out detailed landscape plans. Field trips to homes and gardens. Green
- HS 352 Landscape Design Presentation.** 2(1-2) F,S. An introduction to the technical and aesthetic skills and concerns used in the communication of delineated landscape designs. Projects provide an opportunity to develop individual expertise in the representation of ideas, concepts and essence of design in written and graphic forms. Green
- HS 411 Nursery Management.** Preqs: BS 100, SSC 200. 3(2-3) F,S. Principles and practices of production, management, and marketing of field-grown and container-grown nursery plants. Field trips. Raulston
- HS 414 Residential Landscaping.** Preqs: HS 211, 212, SSC 200. 4(2-6) F,S. Landscape planning and development of residential properties to create an aesthetic and functional composition to complement the home. Required completion of planting plans including design, plant lists, planting details, and technical specifications. Green
- 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 will be applied to the production of specific fruit crops with emphasis on the crops of commercial importance in North Carolina. Staff
- HS 422 Small Fruit Production.** Preqs: BS 100 or BO 200, SSC 200, HS 201. 3(2-3) F. Alt. years. An introduction to the principal small fruit crops grown in the United States their place and value in the agricultural economy and in market and home gardens. Emphasis will be placed on developing an understanding of the basic morphology and physiology of these plants and relating their structural and functional features to intensive and varied cultural practices. Staff
- HS 432 Vegetable Production.** Preqs: BS 100, SSC 200. 3(2-3) F. The origin, importance, distribution, botanical relationships, and principles of production and marketing of the major vegetable crops. Commercial production stressed. (Offered F 1978 and alt. yrs.) Miller
- HS 440 Greenhouse Management.** Preqs: BS 100, SSC 200. 3(2-3) F. Greenhouse site selection, construction, heating, cooling, and maintenance. The influence of environmental factors affecting growth and flowering of floricultural and greenhouse crops. Greenhouse media, fertilization, water sanitation. Field trips to commercial greenhouses. Love
- HS 441 Floriculture I.** Preqs: BS 100, SSC 200. 3(2-3) F. Cultural requirements and marketing procedures for several floricultural crops. Student will become acquainted with these crops through classroom and laboratory experience. Larson
- HS 442 Floriculture II.** Preqs: BS 100, SSC 200. 3(2-3) S. Cultural requirements and marketing procedures for floricultural crops. Acquaintance with these crops through classroom and laboratory experiences. Larson
- HS 471 Arboriculture.** Preqs: BS 100, SSC 200. 3(2-3) S. Principles and practices for care and maintenance of ornamental trees and shrubs. Transplanting, fertilization, control of insects and diseases, bracing and cabling, and control of tree growth by chemical or pruning techniques. Bilderback
- HS 491 Senior Seminar in Horticultural Science.** Preq: Senior standing. 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. DeHertogh
- HS 495 Special Topics in Horticultural Science.** 1 6 F,S. Study in one or more of the following: an intensive literature review, experimental investigation with instructor guidance, or new course development on a trial basis. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

HS (CS) 514 Principles and Methods in Weed Science. Preq: CS 414 or equivalent. 3(2-2) S. Studies on the losses caused by weeds, the ecology of weeds, biological control, basic concepts of weed management, herbicide-crop relationships and herbicide development. Introduction to greenhouse and bioassay techniques used in herbicide work and to field research techniques supplemented by laboratory and field exercises. Monaco

HS (FS) 521 Food Preservation. 3(2-3) F. (See food science.)

HS 531 Physiology of Landscape Plants. Preq: BO 421 or CI. 3(2-3) F. A course designed to cover relationships of plants to landscape environments. Study of plant function, basic climatology and plant physiological principles involved in the selection, utilization and maintenance of physical landscape environments in exterior and interior ornamental landscape plantings. Raulston

HS (CS, GN) 541 Plant Breeding Methods. 3(3-0) F. (See crop science.)

HS (CS, GN) 542 Plant Breeding Field Procedures. 2(0-4) Sum. (See crop science.)

HS 552 Growth of Horticultural Plants. Preq: BO 421. 3(2-3) F. Alt. yrs. Exercises in tissue culture principles and techniques as they relate to horticulture. Emphasis on endogenous controls of plant growth and the role of growth regulating compounds in horticultural research and production. Graduate Staff

HS (FS) 562 Postharvest Physiology. Preq: BO 421. 3(3-0) S. A study of chemical and physiological changes that occur during handling, transportation and storage which affect the quality of horticultural crops. Consideration will be given to preharvest and postharvest conditions which influence these changes. Graduate Staff

HS 599 Research Principles. Preq: CI. Credits Arranged, Maximum 6. Investigation of a problem in horticulture under the direction of the instructor. The students obtain practice in experimental techniques and procedures, critical review of literature and scientific writing. The problem may last one or two semesters. Credits will be determined by the nature of the problem, not to exceed a total of three hours for any one problem. A written report and final oral exam required for completion of course. Graduate Staff

HUMANITIES AND SOCIAL SCIENCES

HSS 298 Transition Colloquium: The Arts in America. Transition students only. 3(3-0) S. One of the courses required in the Transition Program. Through a series of lectures, movies, field trips, and special group projects, this course is designed to complement the study of nineteenth- and twentieth-century American culture by focusing upon the arts in America.

HSS (ALS) 490 International Seminar. Juniors and seniors; upperclassmen interested in International Affairs. 1(1-0) S. (See agriculture and life sciences.)

INDUSTRIAL ARTS

IA 111 Introduction to Industrial Arts. 1(1-0) F.S. A basic course designed to orient the student to the philosophy, objectives, and scope of industrial arts as related to teacher education and industrial employment. A study of the problems and opportunities in the profession. Staff

IA 115 Wood Processing I. 3(1-4) F.S. An introductory course in the design and construction of wood products. The uses of basic hand tools, basic woodworking machines, fasteners and finishes, and the nature of wood as a construction material are included. Cox

IA 122 Metal Technology I. 3(1-4) F.S. An introductory course in the basic design and construction of metal products. Sheet metals, bench metals, foundry, welding, turning, drilling, and cutting are included. Emphasis is upon the nature of the materials with respect to design and machining practices. Cox

IA 231 Industrial Arts Design. Preqs: E 101, IA 115 and 122. 3(1-4) F.S. Principles of

design, functional and aesthetic, as applicable to the creation of products in materials. Emphasis is on individual student experiences and expression. Troxler

IA 233 Metal Technology II. Preq: IA 122. 3(1-4) F,S. This course derives its content from the concepts of machining metals based on the five basic chip-removal metalworking arts of planing, turning, drilling, milling, and grinding. Young

IA 246 Graphics Technology. Preq: High school technical drawing course. 3(1-4) F,S. An introductory course providing basic experiences in letterpress, offset printing, silk screen printing, photography, binding, and finishing. Staff

IA 351 General Ceramics. 3(1-4) F,S. This course is designed to give the student an opportunity to work with ceramic materials as a medium of expression and to get experience in the basic manufacturing processes of the ceramic industry. Emphasis will be given to a study of the sources of clay, designing, forming, decorating, and firing of ceramic products. Troxler

IA 359 Electrical Technology I. Preqs: MA 111, PY 212 or 221. 3(1-4) F,S. A beginning course in electricity-electronics with special emphasis upon understanding the basic concepts of the phenomena of electricity-electronics, technical vocabulary and symbols; the use of formulas in reasoning and computation; securing, organizing, and treatment of data; and the methodology of logical problem solving are stressed. Young

IA 360 Electrical Technology II. Preq: IA 359. 3(2-2) F,S. Continuation of electricity electronics with special emphasis upon the application of electrical principles in consumer and industrial products. Each student is required to design, develop, and construct at least one product as a part of the laboratory experience. Fault analysis will be stressed. Young

IA 364 Wood Processing II. Preq: IA 115. 3(1-4) F,S. Advanced study of woods technology with emphasis on machine processes, materials, and techniques of furniture production. Student work will be concerned with problem solving activities in design, construction and furniture finishing. Cox

IA 368 Technical Drawing II. Preq: E 101. 3(1-4) F,S. The second course in a two-course sequence to provide the industrial arts education student with the additional content and skill necessary to teach drawing courses with confidence and flexibility at the middle school or senior high school level. Troxler

IA 476 Power Technology. Preqs: MA 111, PY 221. 3(1 4) F,S. Power technology is concerned with the development of an understanding of the principles of the creation, transfer and utilization of power. Special emphases are given to both physical concepts and application. Included are: electrical generators and motors, electrical controls, internal combustion engines, hydraulic systems and pneumatic systems. General analysis of faults and their corrections is included. Wenig

IA 480 Modern Industries. Preq: Junior standing. 3(3 0) S. An overview of the function and organization of modern industry. Principles of work simplification, motion economy, processing and scheduling are reviewed. The effects of technological change on labor, management, and the consumer are considered. Attention is focused on contributions of technology to specific industrial processes in machining, forming and fabricating. Young

IA 490 Special Problems in Industrial Arts. Preq: Junior standing; CI. 6 max. F,S. This course enables the student to obtain additional competence in particular areas of industrial arts. The student is assigned an advisor who has special knowledge and skill in the area. The student is expected to define his special interest and to outline the procedures he will follow in meeting it. The advisor approves or asks for modification of the proposal, makes arrangements for laboratory time, and holds regular conferences with the student for purposes of counsel, demonstration and evaluation. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

IA 510 Design for Industrial Arts Teachers. Preqs: Six hours of drawing, IA 231 or equivalent. 3(2-2) Sum. A study of new developments in the field of design with emphasis on the relationship of material and form in the selection and designing of industrial arts projects. Graduate Staff

IA 590 Laboratory Problems in Industrial Arts. Preqs: Sr. standing, CI. Maximum 6.

F,S,Sum. Courses based on individual problems and designed to give advanced majors in industrial arts education the opportunity to broaden or intensify their knowledge and abilities through investigation and research in the various fields of industrial arts, such as metals, plastics, ceramics or electricity-electronics. Graduate Staff

IA 592 Special Problems in Industrial Arts. F,eq. One term of student teaching or equivalent. Maximum 6. F,S,Sum. The purpose of this course is to broaden the subject matter experience in the areas of industrial arts. Problems involving curriculum, investigation or research in one or more industrial arts areas will be required. Graduate Staff

INDUSTRIAL ENGINEERING

IE 200 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. Site visits, discussions and problems which relate to the design and operation of integrated systems of humans, machines, information and materials. Staff

IE 241 Furniture Manufacturing Processes I. Preq: E 240. 3(3-0) S. Survey of furniture manufacturing technology, emphasizing equipment and its relationship to furniture product engineering. Clark

IE 301 Engineering Economy. Preq: MA 111. This course not open to students scheduling IE 311. 3(3-0) F,S,Sum. Criteria and techniques for management and engineering decisions in relation to economy of design, selection and operation. Effects of depreciation policies and machine replacement consideration. Problem solving and development of detailed project economy studies. Staff

IE 307 Business Data Processing. Preq: CSC 111 or equiv. 3(3-0) F,S. Introduction to data processing principles and functions. Analysis and representation of data flow, logic, and procedures. Development of computer-based business applications; processing modes and controls; administrative methods and procedures. Staff

IE 308 Control of Production and Service Systems. IE 307, ST 372, Coreq: IE 352. 4(3-1) S. An intensive study of the strategy for planning and control of production and service system. Taught from a total systems viewpoint, drawing on student's prior experience in statistics, information processing, and cost accounting. Topics include production organization, flow and inventory accumulation. Quality control as well as quantity control is stressed. Emphasis on applications. Alvarez, Blair

IE 311 Engineering Economic Analysis. Preq: Soph. standing. 3(3-0) F,S. 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, Canada

IE 328 Manufacturing Processes. Preq: MAT 201. 3(2-3) F,S. Manufacturing operations for mechanical component parts and assembled products emphasizing: 1) capabilities and limitations of the various processes; 2) the concept of manufacturability, i.e. the interaction between product design, material, process, machine, man, and cost. These points illustrated experimentally. Harder

IE 332 Motion and Time Study. Preq: ST 361. 4(3-3) F,S. Principles and methodology of operation process charting; methods and analysis; motion and micromotion study; and man-machine relationships. Use of predetermined time data; time study procedures, including performance rating, determination of allowances based on workplace, and environmental factors; and applications of wage incentives. C. Smith

IE 340 Furniture Manufacturing Processes II. Preqs: IE 241 and WPS 205. 4(2-6) F. Survey of technology, emphasizing sequence of operations, production rate and the integration of many types of equipment into a manufacturing system. Prak

IE 341 Furniture Plant Layout and Design. Preq: IE 340. 3(1-6) S. Problems in furniture manufacturing plant design; building structures, equipment location, space utilization, layout for operation and control, allied topics in power utilization light, heat, ventilation and safety. Prak

IE 343 Plant Layout and Materials Handling. Preqs: IE 328, 332. 3(1-4) F,S. Location and design of a production facility, considering factors affecting production and impact on environment and community. A major design project based on an operational situation. Includes market analysis; plant location, manufacturing process layout, and economic analysis. Alvarez

IE 345 Principles of Upholstery. Preq: IE 241. 2(2-0) F,S. An examination of product function, frame design principles, upholstery constructions, material properties, and manufacturing processes. A study of the unique problems of upholstery merchandising, order processing, labor utilization, inventory control and costing. Clark

IE 346 Furniture Design and Construction. Preq: IE 340. 2(2-0) S. Selected topics. Emphasis is on panel construction, panel manufacturing and finishing methods and the application in knock down furniture construction (Offered in alt. yrs.) Prak

IE 351 Manufacturing Engineering. Preq: MAT 201. 3(2-3) F. Operations employed in the manufacture of mechanical component parts and assembled products with emphasis on: 1) capabilities and limitations of the various processes in practice; 2) the concept of manufacturability, i.e. the interaction between product design, material, process, machine, man and cost; and 3) the theories associated with these processes. Laboratory periods illustrate and verify points. Harder

IE 352 Work Analysis and Design. Preq: Course in mathematical statistics. 3(1-4) S. Work methods and production processes to improve operator effectiveness and reduce production costs. Techniques studies include those successfully applied in industry such as operation analysis, motion study, value engineering, predetermined time systems, time study and line balancing. The engineering approach to man-machine relationships, methods improvement, standardizing work procedures, and accurate measurement of labor content. Data obtained provide the basis for managerial controls. Blair

IE 355 Introduction to Occupational Safety & Health. Preq: Soph. standing. 3(3-0) F,S. Provides a basic understanding of safety and health practices of contemporary concern to the plant manager, safety engineer, etc. Emphasizes the applications of human factors, biomechanics, work physiology, toxicology, statistics, and engineering in accident prevention and control. Specific instruments used in the measurements of safety and health problems. Ayoub

IE 361 Deterministic Models in Industrial Engineering. Preq: MA 202. 3(3-0) F. Introduction to mathematical modeling, analysis techniques, and solution procedures applicable to decision-making problems in a deterministic environment. Methodologies covered are classical optimization, linear, and dynamic programming. Applications relate to problems in inventory control, production planning and scheduling, project planning, resource allocation, transportation, and personnel assignment. Nuttle

IE 371 Furniture Quality and Production Control. Preqs: IE 307, 340; ST 361. 4(3-3) S. An introduction to statistical techniques applied to industrial problems. Control chart techniques, sampling plans, design of quality standards. Forecasting, inventory control, production planning and scheduling. Organization of quality control and production control. Examples from the furniture industry will be used throughout. Prak

IE 401 Stochastic Models in Industrial Engineering. Preq: An introductory course in probability and/or math statistics. 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. Stidham

IE 402 Quantitative Methods and Optimization. Preq: IE 361. 3(3-0) F. Treatment of decision-making problem structures and quantitative methods beyond those covered in IE

361. Topics covered include linear programming, non-linear programming, integer programming, implicit enumeration, game theory, flow networks, and activity networks, presented from a problem-solving orientation. Nuttle, Stidham

IE 403 Quantitative Methods Practicum. Preqs: IE 361, 401. 3(1-2) S. Application of quantitative methods in industrial engineering to problems originating via case studies, site visits, and/or visits from practitioners. Emphasis on modeling or realistic decision-making problems with every attempt made to analyze and solve problems using quantitative techniques. When applicable, computer codes used as aid to solution. Communication of results of studies an integral part of the course. Stidham, Nuttle

IE 420 Manufacturing Controls. Preq: IE 301. 3(3-0) F,S. Theory and methodology for developing and maintaining profitable manufacturing operations. Development of principles and procedures for control of materials, manpower and costs. Special attention to production and inventory control, equipment utilization, wage classification and cost reduction programs. Staff

IE 421 Information and Control Systems. Preq: Senior standing, course in computer programming. 3(1-4) F,S. Investigation, analysis and development of integrated information processing systems, including management requirements, economic justification, and implementation approaches. Emphasis is on team projects which require analysis of management functions and specification of computer-based procedure design. Staff

IE 432 Methods Engineering. Preq: IE 352. 3(2-3) S. Intensive study of methods analysis and work-design procedures used in manufacturing and service industries. Micro-motion study techniques and development of basic time data. Derivation of standard data and application to work load determination; use of the computer for setting time standards. Applications to assembly line balancing, machine tending assignments, and managerial controls of production operations studied through the use of real-world production problems in project work. Staff

IE 440 Furniture Management Analysis. Preq: IE 341. 3(1-4) F. Economic decision making applied to the furniture industry. The selection of equipment, materials, methods and strategy from several feasible alternatives is studied with the aid of actual case histories. Prak

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. Prak

IE 452 Ergonomics. Preq: Senior standing. 3(2-2) F. 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. Pearson, Ayoub

IE 453 Facilities Design. Preq: Sr. standing in IE. 3(1-4) F. Project of an industrial plant to be designed by small groups of students taking complete initiative and responsibility in procuring the information required by the realistic design for industrial enterprise. Charts of the facilities and a report justifying the design feasibility from the technical, economic, and environmental impact viewpoint produced by each group. Canada

IE 454 Modeling of Man-Machine Systems. Preq: IE 401. 3(2-1) S. Design, improvement, and installation of man-machine systems with emphasis upon the integration of operations research, engineering economy, and ergonomics for the analysis and assessment of systems performance. Analysis of systems typically found in industry; health care and safety fields; and government. Ayoub

IE 470 Furniture Manufacturing Organization. Preq: IE 371. 2(2-0) F. The course is a summary of how management of a furniture company organizes for the most efficient combination of people, materials, machines and financial resources. The emphasis is on organization, interrelations. Ekwall, Clark

IE 471 Furniture Manufacturing Organization Laboratory. Coreq: IE 470. 3(0-6) F. Senior "capstone" project requiring the design of a detailed organization structure and information systems for a furniture manufacturing situation. Ekwvall, Clark

IE 481 Engineering Economics (Mini). Preq: Senior standing and CI. Not for IE, CE, EO, and FMM undergraduates or anyone having received credit for IE 301, IE 311 or equivalent. 1(3-0) S. Time value of money concepts applied to economic comparison of investment and operating alternatives by equivalent annual worth, present worth, and rate of return methods. This course is presented at a rapid-pace during one-third of a semester. Canada, Bernhard

IE 482 Work Methods and Measurement (Mini). Preq: Senior standing and CI. Not for IE and FMM undergraduates or anyone having received credit for IE 332 or equivalent. 1(3-0) F. Review of classical industrial engineering activities: Systematic approach to work design and work measurement including methods analysis, classical time study techniques, predetermined time systems, and work sampling. This course is presented at a rapid-pace during one-third of a semester. Anderson, Blair

IE 485 Manufacturing Engineering (Mini). Preq: Senior standing and CI. Not for IE and EO undergraduates or students who have taken MAT 400 or MAT 423. 1(3-0) F.S. Manufacturing concepts stressing the interrelationship of materials and the processes that are used to develop finished products, with emphasis on metals. This course is presented at a rapid-pace during one-third of a semester. Harder

IE 487 Information Systems (Mini). Preq: Senior standing and CI. Not for IE or FMM undergraduates or other students having received credit for IE 307 or equivalent. 1(3-0) F. An introduction to the generation, flow, processing, reporting and use of business information. System design and development, procedure design and documentation, role of user in system design and use of information. This course is presented at a rapid-pace during one-third of a semester. Phelan, W. Smith

IE 488 Production and Inventory Control (Mini). Preq: Senior standing and CI. Not for IE and FMM undergraduates. 1(3-0) F. An overview of production and inventory control including brief coverage of forecasting, scheduling, expediting, MRP. This course is presented at a rapid-pace during one-third of a semester. Alvarez, Prak

IE 489 Labor Relations for Engineers (Mini). Preq: Senior standing and CI. Industrial employment experience highly desirable (full time, co-op or summer). 1(3-0) F,S. Discussion of problems and constraints faced by engineers or managers in the operation of unionized facilities. Labor agreement provisions, grievance and arbitration procedures. This course is presented at a rapid-pace during one-third of a semester. Carson

IE 490 Special Topics in Industrial Engineering. Preq: Junior or senior standing and CI. 1-3. Generally used for the first offering of a new course, using conventional lecture format. Sometimes used for directed readings, problem sets, written and oral reports as required. Prak, W. Smith, Staff

IE 495 Project Work in Industrial Engineering. Preq: Sr. Standing. 1-6 F,S. Special investigations, study or research related to the fields 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. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

IE (MA, OR) 505 Mathematical Programming I. Preq: MA 405. 3(3-0) F,Sum. A study of mathematical methods applied to problems of planning. Linear programming will be covered in detail. This course is intended for those who desire to study this subject in depth and detail. It provides a rigorous and complete development of the theoretical and computational aspects of this technique as well as a discussion of a number of applications. Graduate Staff

IE (OR) 509 Dynamic Programming. Preqs: MA 405, ST 421. 3(3-0) S. An introduction to the theory and computational aspects of dynamic programming and its application to sequential decision problems. Nuttle, Elmaghraby

IE 511 Advanced Engineering Project Analysis. Preqs: IE 311, ST 421. 3(3-0) F. Analysis of project economy models with certainty assumed, advantages analyses employing probability concepts, sensitivity studies and measures of utility. Estimation techniques and use of accounting information, time series analysis and judgment factors. Planning and uses of capital funds. Canada

IE 515 Advanced Manufacturing Processes. Preqs: IE 351 and EE 331 or equivalent. 3(3-0) F. The course examines manufacturing processes which involve chemical, electrochemical, electrical, thermo-electric and non-conventional mechanical energy modes. Each process is investigated as to its underlying theory, state-of-the-art technology, interaction with the workpiece material, geometric capability and economics. Harder

IE 517 Computer-Aided Manufacturing. Preqs: IE 351 or equivalent and computer programming. 3(3-0) S. This course is concerned with the integration of the elements of production processes into a Computer Aided Manufacturing system (CAM). Students will generate programs for parts production in the APT language, for plotter verification, and for 3-axis machining. The benefits of computer aided design and graphics in designing products for CAM are stressed. Industry case examples of machining, assembly and continuous process operations are studied. Harder

IE 521 Management Decision and Control Systems. Preqs: IE 421, CSC 421 or equivalent. 3(3-0) S. Planning and development of comprehensive computer-based information systems to support management decisions. Formal systems concepts; management information requirements. Management science and organizational behavior influences. Data bases and advanced system techniques and concepts. System evaluation and cost effectiveness. W. Smith

IE (OR) 522 Organizational Systems Dynamics. Preqs: ST 371, IE 421. 3(3-0) F. A study of the behavior of large organizations as simulated on a large digital computer and driven by suitable exogenous inputs. Basic theory of feedback control of systems; methods of modeling for continuous simulation, including aspects of management policy. Projects cover study, modeling and simulation of industrial, business, political social organizations and systems; methods of changing system behavior by modifying parameters and model structure. Blair

IE 523 Production Planning, Scheduling and Inventory Control. Preqs: OR 501 and ST 515 or equivalents. 3(3-0) S. An analysis of Production-Inventory systems. Discussion of commonly used planning and scheduling techniques. Introduction to the use of math modeling for solution of planning and scheduling problems. Interface with quality control and information systems. Alvarez, Nuttle

IE 525 Organizational Planning and Control. Preqs: Three credit hours in operations management (such as EB 325, IE 308). 3(3-0) S. Organization theory and systems approaches to administrative functions. Human and social influences of management systems for planning and control of activity. Policy, structure and procedure related to industrial engineering activities. Effects of automation. (To be taught alt. yrs.) Pearson, W. Smith

IE (PSY) 540 Human Factors in Systems Design. Preqs: IE (PSY) 338 or IE 452. Coreqs: ST 507 or 515. 3(3-0) S. Introduction to problems of the systems development cycle, including man-machine function allocation, military specifications, display-control compatibility, the personnel sub-system concept and maintainability design. Detailed treatment is given to man as an information processing mechanism. Pearson

IE 541 Systems Safety Engineering. Preqs: IE 452, ST 371. 3(3-0) F.Sum. Problems in occupational safety and health; preventive aspects involving product and work design, and personnel selection. Consideration of the methods used in accident-injury study, including field investigation, experimental engineering and biomedical research, statistical studies, and fault tree analysis. Managerial aspects of safety accountability. (To be taught in alt. yrs.) Ayoub, Pearson

IE 547 Reliability and Quality Assurance. Preq: One of the following: IE 308, IE 371, ST 401 or ST 515. 3(3-0) S. An introduction to basic concepts of reliability and quality assurance. Application of probability and statistics to estimation and control of quality and reliability of industrial processes. Control charts and acceptance sampling. Reliability estimation, life testing. Failure distributions and rates. Reliability of systems: series, parallel, and monotone

systems. Maintenance of systems. Redundancy optimization. Quality management in industrial systems. Alvarez, Prak, Stidham

IE 553 Materials Handling Systems. Preq: IE 453. 3(3-0) S. Analysis, design, evaluation and implementation of materials handling systems. Principles, functions, equipment concepts and traditional approaches of materials handling. Impact of facilities design on materials handling and application of quantitative techniques to materials handling systems design. Description of factors and approaches to materials handling management and the criticality of properly designed and operated material flow systems. Tompkins

IE 556 Industrial Logistics. Preq: IE 453. 3(3-0) F. Materials management, materials flow and physical distribution. Management of activities required to move raw materials, parts and finished inventory from vendors, within an enterprise and to customers. This course will cover the design and operation of effective industrial logistics systems. Staff

IE (OR) 561 Queues and Stochastic Service Systems. Preq: MA 421. 3(3-0) F. General concepts of stochastic processes are introduced. Poisson processes, Markov processes and renewal theory are presented. These are then used in the analysis of queues, starting with a completely memoryless queue to one with general parameters. Applications to many engineering problems will be considered. Stidham

IE (CSC, OR) 562 Advanced Topics in Computer Simulation. 3(3-0) S. (See computer science.)

IE (MA, OR) 586 Network Flows. Preqs: IE (OR, MA) 505 or equivalent. 3(3-0) S. This course will study problems of flows in networks. These problems will include the determination of the shortest chain, maximal flow and minimal cost flow in networks. The relationship between network flows and linear programming will be developed as well as problems with nonlinear cost functions, multicommodity flows and the problem of network synthesis. (Offered in alt. yrs.) Graduate Staff

INTERNATIONAL STUDENT ORIENTATION

ISO 100 International Student Orientation. 0(1-0) F,S. Recommended for all foreign students new to the United States. Aims to acquaint them with the Raleigh community, American culture, University academic procedures and U.S. Government regulations. Etchison

LANDSCAPE ARCHITECTURE

(Also see Design.)

LAR 400 Intermediate Landscape Architecture Design (Series). Preq: DF 102. May not be taken more than six times. 6(0-9) F,S. This series of courses covers small scale design, urban landscape architecture, public and institutional design. The problems of project organization, design and execution will be studied in each course. Students select from a number of vertically organized workshop studios which offer on an optional basis a wide range of program emphases.

Selected 500-Level Courses Open To Advanced Undergraduates

LAR 511 Community Design Policy. Preq: Grad. standing or CI. 3(3-0) S. The course explores the theory and practices of the social impact on the designed environment and users of that environment. The public community development process is studied as it relates to the built environment.

LAR 512 Landscape Resource Management. Preq: DN 431 or CI. 3(1 4) S. Laboratory techniques course in the methodology of analysis and management of natural resources as it relates to landscape architecture. Case study approach to managed resource systems using spatial mapping and analysis techniques.

LAR 573 Historic Preservation. Preq: Grad. standing and CI. 3(3-0) F. Seminar covering the legal, administrative, fiscal and political aspects of preserving and conserving buildings, sites, districts, objects and landscapes of architectural, historical, and design significance as

related to community design and planning considerations. Subjects to be treated include federal, state and local statutes and ordinances; federal and state court decisions and administrative processes.

LAR 574 Landscape Design Controls. Preq: Grad. standing and CI. 3(3-0) S. Examination of local, state and federal law, affecting the visual quality of large-unit natural and built environments such as landscapes and townscapes, as expressed in local ordinances, state statutes, executive orders, administrative regulations and court decisions. Emphasis is placed on the legal, administrative, fiscal and governmental tools and processes for maintaining and enhancing visual environmental quality.

LAR 575 Land Development. Preq: Graduate standing or CI. 3(3-0) F,S. The seminar presents the concepts, processes and principles used in the design and development of communities. The discussions will focus on a general development process, the development team and on the role of the designer in the context of the team. A wide range of project types will be discussed. The seminar presents the relationships of public regulatory policies and programs to the community design and development process.

LATIN LANGUAGE AND LITERATURE

LAT 101 Elementary Latin I. 3(3-0) F. An introduction to Classical Literature. Study of five declensions, present and perfect systems of four conjugations, some irregular verbs and basic syntax. Readings from Roman and Greek mythology.

LAT 102 Elementary Latin II. Preq: LAT 101 or equivalent. 3(3-0) F. Continuation and expansion of LAT 101. Various subjunctive uses, active and passive periphrastic conjugations, conditional sentences. Readings from various classical writers.

LAT 201 Intermediate Latin I. Preq: LAT 102. 3(3-0) F. An introduction to Latin prose and poetry. The emphasis is on increased reading skill. A review of grammar fundamentals and an introduction to more complex syntactical structures. The cultural significance of the various readings is examined. An oral report, short paper, and translation exercise are required.

LAT 202 Intermediate Latin II. Preq: LAT 201. 3(3-0) S. A study of the lyric poetry of Catullus and Horace emphasizing vocabulary, syntax, and techniques of Latin verse. The traditions and the evolution of lyric poetry and the social role of the Roman poet are discussed.

MATHEMATICS

MA 100 Precalculus Trigonometry. Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science Program), Biological Sciences (all Options), Mathematics Education, and Science Education, credit in MA 100 does not count toward graduation requirements. 2(2-0) F,S,Sum. Basic topics from plane trigonometry which are needed for the study of calculus: angles, right triangles, trigonometric functions, graphs, identities, inverse functions, trig. equations, laws of sines and cosines.

MA 102 Analytic Geometry and Calculus I. Preq: MA 111 or equivalent completed in high school. Credit in both MA 102 and MA 112 is not allowed. 4(3-2) F,S,Sum. First of three semesters of unified analytic geometry and calculus course. Functions and graphs, limits, derivatives of algebraic functions and applications, indefinite integral, definite integral and the fundamental theorem of calculus, areas and volumes, plane analytic geometry.

MA 111 Algebra and Trigonometry. Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science Program), Biological Sciences (all Options), Mathematics Education, and Science Education, credit in MA 111 does not count toward graduation requirements. 4(3-2) F,S,Sum. Sets and logic, the real number system, polynomials, algebraic fractions, exponents and radicals, linear and quadratic equations, inequalities, functions and relations, logarithms, plane trigonometry.

MA 112 Analytic Geometry and Calculus A. Preq: MA 111 or equiv. completed in high school. Credit in both MA 102 and MA 112 is not allowed. 4(4-0) F,S,Sum. Limits and derivatives, techniques of differentiation, applications, logarithmic exponential and trigonometric functions, higher derivatives, definite integral, applications, integration techniques, examples and applications in biological and behavioral sciences and economics.

MA 113 Introduction to Calculus. Preq: MA 111 or equiv. completed in high school. Credit is not allowed in more than one of MA 102, 112, 113. MA 113 may not be substituted for MA 102 as a curricular requirement. 4(4-0) F,S,Sum. An introductory course for students who require only a single semester of calculus. Emphasis is placed on concepts and applications, along with basic calculus skills. Topics include algebra review, functions, graphs, limits, derivatives, integration, logarithmic and exponential functions, functions of several variables, applications in biological and social sciences.

MA 114 Introduction to Finite Mathematics with Applications. Preq: MA 111 or equivalent completed in high school. 3(3-0) F,S,Sum. Introduction to symbolic logic; elementary probability—probability measures, conditional probability, expected value; elementary matrix algebra; addition and multiplication, inverses, systems of linear equations. Markov chains; introduction to linear programming; applications in the behavioral, managerial and biological sciences.

MA 115 Introduction to Contemporary Mathematics. Credit in MA 115 is not allowed if student has credit for MA 102, 111, 112 or 114. Credit toward graduation is not given for MA 115 in most curricula. 3(3-0) F,S,Sum. Basic skills are emphasized—addition, subtraction, multiplication, and division of fractions; rules of exponents; solving linear and quadratic equations; graphs; logarithms; “word” problems. Interwoven in the above topics is material of a less formal nature, indicating some of the recreational and useful aspects of mathematics.

MA 116 Topics in Contemporary Mathematics. Preq: MA 115 or equiv. completed in high school. Credit in MA 116 is not allowed if student has credit for MA 102, 112 or 114. 3(3-0) F,S,Sum. Primarily for Humanities and Social Sciences students. Instructors prepare a list of topics, or modules, from which each student chooses four to study for the semester. Examples of modules which are and/or have been offered include: the 4th Dimension, Numbers and Sets, Mathematics in Biology, Puzzles and Graphs, Cryptography, Mathematical Games, Mathematics in Finance, Mathematics in Music, Probability, Statistics, and Computing Machines.

MA 122 Mathematics of Finance. Preq: MA 111 or 115 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 127 Recreational Mathematics. Preq: MA 111 or 115 or equiv. completed in high school. 3(3-0) S. Requires algebra, trigonometry, and a willingness to engage in new types of mathematical thought. Games and puzzles, tricks, geometric figures, model building, fallacies, paradoxes, curiosities, anecdotes, conjectures, famous problems, mathematical humor and more. Mathematical treatments involve number theory, set theory, algebra, topology, combinatorics, geometry, probability, analysis, computer science, math history.

MA 201 Analytic Geometry and Calculus II. Preq: MA 102. 4(4-0) F,S,Sum. Second of three semesters of unified analytic geometry and calculus course. Applications of definite integral. Transcendental functions, methods of integration, polar coordinates, parametric equations, brief introduction to determinants and matrices.

MA 202 Analytic Geometry and Calculus III. Preq: MA 201. 4(4-0) F,S,Sum. Third of three semesters of unified analytic geometry and calculus course. Introduction to infinite series, vector functions, analytic geometry of three dimensional space and partial differentiation, multiple integration, applications. Line integral and Green's Theorem.

MA 212 Analytic Geometry and Calculus B. Preq: MA 112. 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 214 Elementary Probability. Preq: MA 112 or 102. 3(3-0) F,S,Sum. Basic concepts, elementary counting procedures conditional probability, discrete random variables, infinite sample spaces, continuous random variables, continuous time stochastic processes, examples and applications in biological and behavioral sciences.

MA 301 Applied Differential Equations I. Preq: MA 202. Credit is not allowed in both MA 301 and MA 312. 3(3 0) F,S,Sum. First order differential equations, applications, linear equations of higher order, applications in mechanics and other areas, Laplace transforms, systems of linear equations and their applications.

MA 303 Linear Analysis. Preq: MA 202; Coreq: ST 361. Credit not allowed if credit has been obtained for MA 301, 312 or 405. 3(3-0) S. Linear equations of first and second order, compound interest and amortizations; differential equations of first and second order, growth and decay problems, population growth; matrix and vector algebra, simultaneous equations, eigenvalues, diagonalization, systems of difference and differential equations, population problems and Markov chains.

MA 312 Introduction to Differential Equations. Preq: MA 201 (202 desirable). 3(3-0) F,S. First order differential equations, basic theory and applications of linear equations. Systems of linear equations, matrix methods, series solutions, Laplace transforms, existence and uniqueness.

MA 401 Applied Differential Equations II. Preq: MA 301 or 312. 3(3-0) F,S,Sum. The wave, heat and Laplace equations. Solutions by separation of variables and expansion in Fourier Series or other appropriate orthogonal sets.

MA 403 Introduction to Modern Algebra. Preq: One year of calculus. 3(3-0) F,S,Sum. Sets and mappings; equivalence relations; groups, homomorphisms, cosets, Cayley's Theorem, symmetric groups, quotient groups, rings, integral domains, Euclidean algorithms, polynomial rings, ideals, quotient rings.

MA 404 Affine and Projective Geometry. Preq: MA 403 and 405. 3(3 0) S. Introduction to geometry of Euclidean, affine and projective spaces with emphasis on important groups of symmetries of these spaces.

MA 405 Introduction to Linear Algebra and Matrices. Preq: One year of calculus. 3(3-0) F,S,Sum. Linear equations, linear dependence and vector spaces, inner products, linear transformations and matrices, operations with matrices, determinants, eigenvalues and reduction of matrices to diagonal forms, introduction to quadratic forms, applications. (A special section, MA 405M, is given for mathematics majors.)

MA 408 Foundations of Euclidean Geometry. Preq: MA 403. 3(3-0) F. 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. Preq: One year of calculus. 3(3-0) S. Concerned with investigation of arithmetic properties of the integers. Congruences, arithmetic functions, quadratic residues, the quadratic reciprocity Law of Gauss, primitive roots, diophantine equations, and algebraic number fields.

MA 412 Introduction to Combinatorics. Preqs: MA 403 or CSC 322. 3(3-0) Alt. yrs. Problems of enumeration, distribution and arrangement. Inclusion exclusion principle, generating functions, difference equations. Combinatorial identities. Systems of distinct representatives and matching problems. Finite designs. Potential applications in computer science, statistics, physics, operations research, chemistry, and other sciences.

MA 414 Introduction to Differential Geometry. Preqs: MA 202 and MA 405. 3(3-0) S. In introduction to the geometry of curves and surfaces from a modern point of view; calculus in Euclidean spaces, differential forms, frame fields, connections, calculus on surfaces as manifolds, integration of forms, curvatures, isometries, orientations, geodesics.

MA 421 Introduction to Probability. Preq: One year of calculus. 3(3-0) F,S,Sum. Axioms of probability, conditional probability, combinatorial analysis, random variables, expectation, simple stochastic processes.

MA 425 Mathematical Analysis I. MA 202 (403 desirable). 3(3-0) F. Real number system,

functions and limits, topology on the real line, continuity, differential and integral calculus for functions of one variable. Infinite series.

MA 426 Mathematical Analysis II. Preqs: MA 425 and 405. 3(3-0) S. Uniform convergence, calculus of several variables, topology in n -dimensions, limits, continuity, differentiability, implicit functions, multiple integrals, line and surface integrals.

MA (CSC) 427 Introduction to Numerical Analysis I. Preqs: MA 301 or 312 and programming language proficiency. 3(3-0) F. For undergraduate students in any department who wish to learn the theory and practice of computational procedures using a digital computer. Topics include: approximation of functions by interpolating polynomials; numerical differentiation and integration; solution of systems of ordinary differential equations including both initial value and boundary value problems. Computer applications and techniques.

MA (CSC) 428 Introduction to Numerical Analysis II. Preqs: MA 405 and programming language proficiency. 3(3-0) S. For students who wish to learn computational procedures using digital computers. Topics include: solution of linear and nonlinear equations; matrices and eigenvalue calculations; orthogonal polynomials and Gaussian quadrature; curve fitting and function approximation by least squares; smoothing formulas; minimax approximations. [MA (CSC) 427 is not a prerequisite.]

MA 430 Mathematical Models in the Physical Sciences. Preqs: MA 301 or 312 and 405. 3(3-0) F. The formulation of mathematical models in the physical sciences; mathematical techniques used in building such models and in analyzing them. Models related to motion problems, vibrations, dynamical systems, control theory, diffusion, crystallography, coding theory.

MA 432 Mathematical Models in Life Sciences and Social Sciences. Preqs: MA 301 or 312, MA 405. Coreqs: MA 421 or ST 371. 3(3-0) S. Mathematical modeling in the life sciences and social sciences, built around general concepts such as growth modeling (e.g. population growth) to which many different mathematical techniques may be applied (e.g. differential equations, probability, linear algebra).

MA 433 History of Mathematics. Preq: One year of calculus. 3(3-0) F,S,Sum. 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 491 Reading in Honors Mathematics. Preq: Membership in honors program, consent of department. 2-6 F,S.

MA 493 Special Topics in Mathematics. Preq: Consent of department. 1-6 F,S.

Selected 500-Level Courses Open To Advanced Undergraduates.

MA 501 Advanced Mathematics for Engineers and Scientists I. Preq: MA 301 or equivalent. 3(3-0) F. Survey of mathematical methods for engineers and scientists. Ordinary differential equations and Green's functions; partial differential equations and separation of variables; special functions, Fourier series. Applications to engineering and science are stressed. This course cannot be taken for credit by mathematics majors.

MA 502 Advanced Mathematics for Engineers and Scientists II. Preq: MA 301 or equivalent. 3(3-0) S. Determinants and matrices; line and surface integrals, integral theorems; complex integrals and residues; distribution functions of probability. This course cannot be taken for credit by mathematics majors.

MA (IE, OR) 505 Mathematical Programming I. 3(3-0) F,Sum. (See industrial engineering.)

MA 511 Advanced Calculus I. Preq: MA 301 or 312. 3(3-0) F,S,Sum. Fundamental theorems on continuous functions; convergence theory of sequences, series and integrals, the Riemann integral.

MA 512 Advanced Calculus II. Preq: MA 301 or 312. 3(3-0) F,S,Sum. General theorems of partial differentiation; implicit function theorems; vector calculus in 3-space; line and surface integrals; classical integral theorems.

MA 513 Introduction to Complex Variables. Preq: MA 511 or 425. 3(3-0) F,S,Sum. Operations with complex numbers, derivatives, analytic functions, integrals, definitions and properties of elementary functions, multivalued functions, power series, residue theory and applications, conformal mapping.

MA 514 Methods of Applied Mathematics. Preq: MA 511 or 425. 3(3-0) S,Sum. Introduction to integral equations, the calculus of variations and difference equations.

MA 515 Linear Functional Analysis I. Preq: MA 426. 3(3-0) F. Metric spaces; Lebesgue measure and integration; L^p and l^p spaces; Riesz-Fischer and Riesz representation theorems; normed linear spaces and Hilbert spaces.

MA 516 Linear Functional Analysis II. Preq: MA 515. 3(3-0) S. Basic theorems in Banach spaces, dual spaces, weak topologies; basic theorems in Hilbert spaces, and detailed theory of linear operators on Hilbert spaces; spectral theorem for self-adjoint completely continuous linear operators.

MA 517 Introduction to Topology. Preq: MA 426. 3(3-0) F. Sets and functions, metric spaces, topological spaces, compactness, separation, connectedness.

MA 518 Calculus on Manifolds. Preq: MA 426. 3(3-0) S. Calculus of several variables from a modern viewpoint. Differential and integral calculus of several variables, vector functions, integration on manifolds, Stokes' and Green's theorems, vector analysis.

MA 520 Linear Algebra. Preq: MA 405. 3(3-0) F. Vector spaces, linear mappings and matrices, determinants, inner product spaces, bilinear and quadratic forms, canonical forms, spectral theorem.

MA 521 Fundamentals of Modern Algebra. Preqs: MA 403 and 520. 3(3-0) S. Groups, normal subgroups, quotient groups, Cayley's theorem, Sylow's theorem. Rings, ideals and quotient rings, polynomial rings. Fields, extension fields, elements of Galois theory.

MA 523 Topics in Applied Mathematics. Coreqs: MA 515, 520. 3(3-0) F. Formulation of scientific problems in mathematical terms, interpretation and evaluation of the mathematical analysis of the resulting models. The course will discuss problems in behavioral and biological sciences as well as problems in mechanics of discrete and continuous systems. Some discussion of optimization and the calculus of variations.

MA 524 Mathematical Methods in the Physical Sciences I. Preqs: MA 405, 512. 3(3-0) F. Green's functions and two-point boundary value problems; elementary theory of distributions; generalized Green's functions. Finite and infinite dimensional inner product spaces; Hilbert spaces; completely continuous operators; integral equations; the Fredholm alternative; eigenfunction expansions; applications to potential theory. Nonsingular and singular Sturm-Liouville problems; Weil's theorem.

MA 525 Mathematical Methods in the Physical Sciences II. Preq: MA 524. 3(3-0) S. Distribution theory in n -space; Fourier transforms; partial differential equations, generalized solutions, fundamental solutions, Cauchy problem, wave and heat equations, well-posed problems. Laplace's equation, the Dirichlet and Neumann problems, integral equations of potential theory, Green's functions, eigenfunction expansions.

MA (CSC) 529 Numerical Analysis I. Preqs: MA 511 or equivalent, MA 405. 3(3-0) F. This course is designed for graduate and advanced undergraduate students who wish to learn the theory of numerical analysis of systems of linear equations, solutions to nonlinear equations, interpolation theory, and divided differences. Understanding of the theory behind the various techniques and their error estimates will be stressed. Illustrations of the use and limitations of these methods on the computer will be included.

MA (CSC) 530 Numerical Analysis II. Preq: MA (CSC) 529. 3(3-0) S. This course is a continuation of CSC (MA) 529. Topics to be covered are numerical integration, numerical solutions of ordinary differential equations, and numerical solutions of partial differential equations.

MA 532 Theory of Ordinary Differential Equations. Preqs: MA 301 or 312, 405, advanced calculus. 3(3-0) S. Existence and uniqueness theorems, systems of linear equations, fundamental matrices, matrix exponential, series solutions, regular singular point; plane autonomous systems, stability theory.

MA 534 Introduction to Partial Differential Equations. Preqs: MA 425 or MA 511, MA 301 or MA 312. 3(3-0) F. Theory of characteristics and classification of second order equations, existence, uniqueness and representation of solutions for the wave equation, Dirichlet and Neumann boundary-value problems for the Laplace equation, potential theory in two and higher dimensional domains, mean-value theorem and the maximum principle, Green's identities, initial boundary-value problems of heat equation and wave equation. Maximum principle of parabolic equation, method of eigenfunction expansions, Fourier series and Fourier transforms.

MA (CSC) 536 Theory of Sequential Machines. Preq: CSC 412 or grad. standing. 3(3-0) F. Sequential machine identification experiments. Finite-Memory machines. Special classes of machines. Decomposition of sequential machines. Linear sequential machines. Sequential relations of finite-state machines.

MA (CSC) 537 Theory of Computability. Preq: CSC 412 or grad. standing. 3(3 0) S. The concept of effective computability. Turing Machines. Primitive recursive functions. The μ -operator. μ -recursive functions. Godel numbering. Equivalence of Turing Machines and μ recursion. Undecidable predicates. Universal Turing Machines. Other formulations of the concept of effective computability.

MA (ST) 541 Theory of Probability I. Preq: MA 425 or 511. 3(3 0) F,Sum. Axioms, combinatorial analysis, conditional probability, independence, random variables, expectation, special discrete and continuous distributions, probability and moment generating functions, central limit theorem, laws of large numbers, branching processes, recurrent events, random walk.

MA (ST) 542 Introduction to Stochastic Processes. 3(3-0) S. (See statistics.)

MA 545 Set Theory and Foundations of Mathematics. Preq: MA 403. 3(3-0) S. Logic and the axiomatic approach, the Zermelo-Fraenkel axioms and other systems, algebra of sets and order relations, equivalents of the Axiom of Choice, one-to-one correspondences, cardinal and ordinal numbers, the Continuum Hypothesis.

MA (PY) 555 Mathematical Introduction to Celestial Mechanics. Preq: One year of advanced calculus. 3(3-0) F. Central orbits, N-body problem, 3-body problem, Hamilton-Jacobi theory, perturbation theory, applications to motion of celestial bodies.

MA (PY) 556 Orbital Mechanics Preqs: MA 301, 405, knowledge of elementary mechanics and computer programming. 3(3 0) S. Keplerian motion, iterative solutions, numerical integration, differential corrections and space navigation, elements of probability, least squares, sequential estimation, Kalman filter.

MA (BMA, ST) 571 Biomathematics I. 3(3 0) F. (See biomathematics.)

MA (BMA, ST) 572 Biomathematics II. 3(3-0) S. (See biomathematics.)

MA 581 Special Topics. Preq: Consent of department. 1-6 F.S.

MA (CSC) 582 Special Topics in Numerical Solution of Linear Algebraic Equations. Preqs: MA 405 or equivalent and a knowledge of computer programming. 3(3-0) S. A mathematical and numerical investigation of direct, iterative and semiterative methods for the solution of linear systems. Methods for the calculation of eigenvalues and eigenvectors of matrices.

MA (CSC) 583 Special Topics in the Numerical Solution of Ordinary Differential Equations. Preq: Knowledge to the level of CSC 427. 3(3-0) S. Numerical methods for initial value problems including predictor corrector, Runge-Kutta, hybrid and extrapolation methods; stiff systems; shooting methods for two-point boundary value problems; weak, absolute and relative stability results.

MA (CSC) 584 Special Topics in the Numerical Solution of Partial Differential Equations. Preq: Knowledge to the level of CSC 427, 428. 3(3-0) F. Numerical methods for the solutions of parabolic, elliptic, and hyperbolic partial differential equations including stability and convergence results.

MA (CSC OR) 585 Graph Theory. 3(3-0) F. (See computer science.)

MA (IE, OR) 586 Network Flows. 3(3-0) S. (See industrial engineering.)

MECHANICAL AND AEROSPACE ENGINEERING

MAE 200 Mechanical Technology in Contemporary Society. 3(3-0). F.S. The role of mechanical and aerospace engineering in our present technological society with approaches used by engineers in solving problems. Topics include: power generation, modern flight, and transportation vehicles.

MAE 205 Energy: Sources, Uses and Conservation. Preq: Soph. standing. Cannot be taken as a technical elective by students in School of Engineering. 3(3-0) F,S. Broad coverage of the field for concerned and energy conscious students. Sources both current and prospective, and the uses, limitations, and conservation of energy are considered from an individual as well as an institutional point of view. (Technical background not required).

MAE 206 Engineering Statics. Preq: PY 205; Coreq: MA 202. 3(3-0) F,S,Sum. Basic concepts, forces and equilibrium, distributed forces, virtual work, and inertial properties; application to machines, structures and systems

MAE 208 Engineering Dynamics. Preq: MAE 206; Coreq: MA 301. 3(3-0) F,S,Sum. Equations of motion; kinematics, kinetics of mass points and systems of mass points; kinematics and kinetics of rigid bodies; dynamics of nonrigid systems.

MAE 216 Elements of Mechanical Engineering. Preq: MAE 206, PY 208 or 202. 3(3-0) F,S. An introduction to mechanical engineering emphasizing the application and extension of chemistry, physics and mathematics to real engineering problems in analysis and design.

MAE 250 Introduction to the Airplane and Its Operation. Preq: Sophomore standing. Not acceptable as departmental elective in Mechanical or Aerospace Engineering. 3(3-0) F. A presentation of why airplanes look and fly as they do. Theory of flight and aircraft control, factors affecting aircraft operations and aerial navigation. Includes field trips to maintenance, control and flight facilities at regional airports.

MAE 261 Aerospace Vehicle Performance. Preqs: MA 201, PY 205. 3(3-0) S. Introduction to the problem of performance analysis in aerospace engineering. Aircraft performance in gliding, climbing, level and turning flight. Calculation of vehicle range and endurance. Simple orbital mechanics.

MAE 301 Engineering Thermodynamics I. Preqs: MA 202, 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 is placed 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 and refrigeration cycles is also studied.

MAE 302 Engineering Thermodynamics II. Preq: MAE 301. 3(3-0) S,Sum. Emphasis on 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 303 Engineering Thermodynamics III. Preq: MAE 301. 3(3-0) S. For non-mechanical engineering jrs. Thermodynamics of mixtures; thermodynamics of fluid flow, heat transfer, vapor and gas cycles, and applications.

MAE 305 Mechanical Engineering Laboratory I. Coreq: MAE 301. 1(0-3) F,Sum. Introduction to the theory and practice of measurement and experimental data collection. The components of the generalized measurement system are studied and their effects on the final result evaluated. Basic methods of data analysis as well as basic instrumentation for sensing, conditioning and displaying experimental quantities are covered.

MAE 306 Mechanical Engineering Laboratory II. Preqs: MAE 305, EE 331. 1(0-3) S,Sum. Specific types of measurements. Students evaluate and compare different instrumentation for measuring the same physical quantity on the basis of cost, time required, accuracy, etc.

MAE 307 Energy and Energy Transformations. Preqs: MA 201, PY 212. 3(3-0) F. Energy transformation as permitted by the First Law and limited by the Second Law. Properties of

ideal gases and actual gases; properties of vapors. Vapor power cycles; vapor refrigerating cycles, gas cycles for internal combustion engines and gas turbines. Elements of heat transfer.

MAE 308 Fluid Mechanics. I. Preq: CE 213 or MAE 206. 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 1) fluid statics, 2) inviscid, incompressible fluid flow and 3) viscous, incompressible fluid flow.

MAE 309 Fluid Mechanics II. Preq: MAE 308. 3(3-0) Alt. yrs. Further applications of the basic equations of fluid mechanics to 1) boundary layers and analysis, 2) laminar and turbulent flows and 3) compressible fluid flow. Introduction to experimental methods in fluid mechanics.

MAE 314 Solid Mechanics. Preq: MAE 206. 3(3-0) F,S,Sum. Stresses, strains, constitutive laws, yield and fracture; application to axial, bending, torsional and plane stress states; deflection and stability analyses.

MAE 315 Dynamics of Machines. Preq: MAE 216, 208. 3(3-0) F,S,Sum. A rational application of dynamics to the analysis of machines and mechanical devices to determine the motions resulting from applied loads and the forces and inputs required to produce specified motions.

MAE 316 Strength of Mechanical Components. Preq: MAE 206; Coreq: MAT 201. 3(3-0) F,S. Stress, strain and deformation analysis of mechanical components and their strength determination based on material behavior under static and dynamic operating conditions. Applications to basic machine components.

MAE 355 Aerodynamics I. Preqs: MAE 261, MA 301. 4(3-3) F. Introductory concepts of perfect fluid theory and incompressible boundary layers with application to computing the aerodynamic characteristics of airfoils, wings and flight vehicle configurations.

MAE 356 Aerodynamics II. Preqs: MAE 355, 301. 4(3-3) S. Concepts of thermodynamics, compressible fluid flow and compressible boundary layers with application to computing the aerodynamic characteristics of airfoils, wings and flight vehicle configurations at high speed.

MAE 365 Propulsion I. Preqs: MAE 355, MAE 301. 3(3-0) S. One dimensional internal flow of compressible fluids, combustion and thermochemistry problems. Applications to air-breathing aircraft propulsion system.

MAE 371 Aerospace Vehicle Structures I. Preqs: MAE 261, 206. 3(3-0) F. Theory and concepts required for the analysis and design of flight vehicle structural members. Properties and selection of materials; methods of analysis for axial, torsional, flexural and transverse shear loadings of typical flight structure members.

MAE 401 Energy Conversion. Preq: MAE 302. 3(3-0) F,S. Principles of thermodynamics, fluid mechanics, heat transfer and combustion applied to power generation. Principles, feasibility, and limitations of conventional and direct energy conversion methods are studied. The economics of energy conversion. Present and possible future energy sources.

MAE 402 Heat and Mass Transfer. Preqs: MAE 302, MA 301. 3(3-0) F,S. The fundamental relationships of steady and transient heat transfer by conduction, convection, radiation and during changes of phase; mass transfer by diffusion and convection, simultaneous mass and heat transfer.

MAE 403 Air Conditioning. Preq: MAE 302. 3(3-0) F. Study of the 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 disassemblers; performance and selection of pumps and fans; temperature and humidity control.

MAE 404 Refrigeration. Preq: MAE 302. 3(3-0) S. Thermodynamic analysis of the vapor compression cycle, absorption refrigeration; 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. The final undergraduate course in the mechanical laboratory sequence emphasizing the experimental investigation of measurement problems involving typical mechanical engineering equipment systems. Also included are statistical treatment of data, experiment planning, engineering report preparation, and experience in oral technical presentations.

MAE 406 Energy Conservation in Industry. Preqs: MAE 301 or 307. Junior or senior status in Engineering. 3(2-3) S. The application of energy conservation principles to a broad range of industrial situations. Topics to be covered include electrical energy consumption, heat recovery, steam traps, boilers, insulation, compressed air, heating, ventilation, air conditioning, instrumentation, and measurement. Student participation on field trips to local industry focusing on identifying energy conservation opportunities and measuring energy losses.

MAE 407 Steam and Gas Turbines. Preqs: 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. Preq: MAE 302. 3(3-0) F. Fundamentals common to internal combustion engine cycles of operation. The Otto engine: carburetion, fuel distribution, flame and spark timing, and altitude effects; the Diesel engine: injection knock, combustion, precombustion and scavenging as applied to reciprocating and rotary engines.

MAE 409 Particulate Control in Industrial Atmospheric Pollution. Preq: MAE 301 or equivalent. 3(3 0) F. Combustion calculations and analysis of particulate emission and gases from industrial and utility power stations burning various types of fuel. State and Federal pollution codes, requirements for compliance and enforcement. Calculations and design of industrial equipment. Utilization of waste products.

MAE 411 Machine Component Design. Preqs: MAE 315, 316. 3(3-0) F. Applying engineering and materials sciences to the analysis and design of machine components including fasteners, springs, bearings, gears, shafts, clutches, brakes, couplings, etc.

MAE 415 Mechanical Engineering Analysis. Preqs: MAE 302, 315, 316, EE 331. 3(3-0) F.S. A logical method of problem solving through the integration of the physical sciences, engineering sciences and mathematics. Training in methods of analysis of real mechanical engineering problems.

MAE 416 Mechanical Engineering Design. Preq: MAE 415. 4(3-2) S. Applying engineering and materials sciences to the total design of mechanical engineering components and systems. Consideration and utilization of the design process including problem definition, solution synthesis, design analysis, optimization and prototype evaluation through design project activity.

MAE 422 Direct Energy Conversion. Preqs: MAE 301, EE 202 or 332. 3(3-0) S. Theory and application of direct energy conversion methods, including magnetohydrodynamic and electrodynamic generators, fuel cells, and other methods of current interest. Thermodynamic analyses, device characteristics, and design considerations.

MAE 431 Thermodynamics of Fluid Flow. Preqs: MAE 301, 308, MA 301. 3(3-0) S. Application of one dimensional compressible gas dynamics and perfect gas theory to analyze nozzle and diffuser flows, normal shocks, and constant-area frictional flows with and without heat transfer.

MAE 435 Principles of Automatic Control. Preq: MA 301. 3(3-0) S. Study of linear feedback control systems using transfer functions. Transient and steadystate responses. Stability and dynamic analyses using root locus and frequency response techniques (Bode plots and Nyquist diagrams). Active and passive compensation methods. Applies classical control theory techniques to determination and modification of the dynamic response of a system. Applications to typical mechanical and aerospace engineering control systems.

MAE 442 Automotive Engineering. Preq: Senior in engineering. 3(3-0) S. Designed to acquaint the student with the fundamental aspects of automotive engineering. Examines various automotive systems (engine, brakes, etc.) as well as their interactions in such areas as safety. Current practices and development for the future are considered.

MAE 452 Aerodynamics of V/STOL Vehicles. Preq: MAE 355. 3(3-0) F. Introduction to the aerodynamics and performance of vertical take-off and landing (VTOL) and short takeoff and landing (STOL) vehicles. The aerodynamics of propellers and rotors. Helicopter aerodynamics. High lift devices. Relationship between design and economics for V/STOL vehicles.

MAE 455 Boundary Layer Theory. Preq: MAE 355. 3(3-0) F. Introduction to the concept of boundary layers and the manner in which the boundary layer affects the lift, drag and heat transfer on aerospace vehicles. Included are discussions of the laminar and turbulent boundary layers in compressible flows.

MAE 462 Flight Vehicle Stability and Control. Preqs: MAE 261, 435. 3(3 0) F. 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 dynamic behavior by vehicle design (stability derivatives) and/or flight control systems.

MAE 465 Propulsion II. Preq: MAE 365. 4(3-3) F. Performance analysis of components and complete air-breathing propulsion systems. Performance analysis and design of liquid fuel and solid fuel rocket propulsion systems.

MAE (MAS) 471 Undersea Vehicle Design. Preq: MAE 355 or MAE 308. 3(3-0) Alt. yrs. Solution of problems encountered in the design of both submerged and semisubmerged ocean vehicles. Treatment of vehicle drag and lift, buoyancy effects, vehicle propulsion and systems integration.

MAE 472 Aerospace Vehicle Structures II. Preq: MAE 371. 4(3-3) S. A continuation of MAE 371 emphasizing specialized topics such as semi-monocoque structures, deflection of structures, indeterminate structures, torsion analysis. Laboratory demonstration of the theory and application of resistance strain gages, load-stress deflection tests on typical flight vehicle structure components, the determination of basic materials properties, and correlation of tests and analytical results.

MAE 478 Aerospace Vehicle Design I. Preqs: MAE 356, 472; Coreq: MAE 462, 465. 2(2-0) 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 synthesis of previously acquired theoretical and empirical knowledge and application to the design of practical aerospace vehicle systems.

MAE 495 Special Topics in Mechanical and Aerospace Engineering. 1-3 F.S. 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. Thermodynamics of a general reactive system; conservation of energy and the principles of increase of entropy; the fundamental relation of thermodynamics; Legendre transformations; equilibrium and stability criteria in different representation; general relations; chemical thermodynamics; multi reaction system; ionization; irreversible thermodynamics; the Onsager relation; applications to thermoelectric, thermomagnetic and diffusional processes.

MAE 502 Advanced Energy Systems. Preq: MAE 401. 3(3 0) F. Alt. yrs. An engineering examination of energy sources, both conventional and proposed. Review of existing energy conversion systems and a critical examination of advanced systems, such as magnetohydrodynamics, fuel cells, solar, geothermal, wind, tides, thermal gradients in oceans and the hydrogen economy.

MAE 503 Advanced Power Plants. Preq: MAE 401. 3(3-0) F. Alt. yrs. A critical analysis of the energy balance of thermal power plants, thermodynamics and economic evaluation of alternate schemes of development; study of recent development in the production of power.

MAE 504 Fluid Dynamics of Combustion I. Preqs: MAE 301, MAE 355 or MAE 308 3(3-0) F. Alt. yrs. Gas-phase thermochemistry including chemical equilibrium and introductory chemical kinetics. Homogeneous reaction phenomena. Subsonic and supersonic combustion

waves in premixed reactants (deflagration and detonation). Effects of turbulence. Introduction to diffusion flame theory.

MAE 505 Heat Transfer Theory and Applications. Preq: MAE 402 or equivalent 3(3-0) F. Development of basic equations for steady and transient heat and mass transfer processes. Emphasis is placed on the application of the basic equations to engineering problems in the areas of conduction, convection, mass transfer and thermal radiation.

MAE 506 Advanced Automotive Energy Systems. Preq: MAE 408. 3(3-0) S. A critical study of the various cycles and energy systems for automotive transportation is carried out. The feasibility of automotive Rankine cycle power plants, Sterling engines, gas turbines and hydrogen-air fueled engines is discussed. Means of improving the efficiency and exhaust emissions of internal combustion engines and the use of alternative fuel sources are considered.

MAE 510 Effects of Noise and Vibration on Man. Preqs: Sr. standing in Engineering, MA 301. 3(3-0) Alt. S. Study of the effects of noise and vibration on man. Topics covered include acoustic and vibration fundamentals, auditory and non-auditory response to noise, subjective response to noise, environment noise, body physical characteristics, effects of vibration and shock exposure.

MAE 513 Vibration of Mechanical and Structural Components. Preq: MAE 315 or 472; Coreq: MA 511. 3(3-0) F. Modeling of mechanical and structural systems for vibration analysis and presentation of exact and approximate solution techniques. Techniques of vibration control are presented and experience on the digital computer is provided.

MAE 514 Industrial Noise Control. Preq: MAE 315. 3(2-3) S. Provides definition of the industrial noise problem, development of analytical problem solving skills, introduction to instrumentation, involvement in design project, laboratory demonstrations.

MAE 517 Instrumentation in Sound and Vibration Engineering. Preq: EE 331. Coreq: MAE 513. 3(3-0) S. This course is devoted to a presentation of measurement techniques and the theory and operation of transducers and amplifiers. An introduction to signal analysis techniques such as power spectral density and correlation is also provided.

MAE 518 Acoustic Radiation I. Preqs: MA 301 and MAE 308 or MAE 356. 3(3-0) F. An introduction to the principles of acoustic radiation from vibrating bodies and their related fields. The radiation of simple sources, the propagation of sound waves in confined spaces and transmission through different media are considered.

MAE 519 Theory of Noise in Transportation Systems. Preq: MAE 550. 3(3-0) S. Alt. yrs. A study of the basic noise generating mechanisms encountered in transportation systems. Coverage includes jet noise, propeller noise, helicopter noise, fan and compressor noise, aircraft induced community noise, surface vehicle noise models and efforts to control noise in transportation systems.

MAE 525 Advanced Flight Vehicle Stability and Control. Preq: MAE 462. 3(3-0) Alt. yrs. Preliminary analysis and design of flight control systems to include autopilots and stability augmentation systems. Study of effects of inertial cross-coupling and nonrigid bodies on vehicle dynamics.

MAE 526 Inertial Navigation Analysis and Design. Preq: MAE 435 or 462. 3(3-0) S. Alt. yrs. Performance analysis and engineering design of inertial navigation components, sub-systems and systems. Development of transfer functions and application of linear system techniques to determine stability, transient response and errors of gyroscopes, accelerometers, stable platforms and inertial alignment systems. Error analysis and its significance. Preliminary analysis and design of typical inertial navigation systems for aircraft and marine vehicles.

MAE (MAT) 531 Materials Processing by Deformation. Preq: Six hours of solid mechanics and/or materials. 3(3-0) F. The course involves a presentation of the mechanical and metallurgical fundamentals of materials processing by deformation. Topics to be discussed include: principles of metal working, friction, forging, rolling, extrusion, drawing, high energy rate forming, chipless forming techniques, manufacturing system concept in production.

MAE (MAT) 532 Fundamentals of Metal Machining Theory. Preq: Six hours of solid mechanics and/or materials. 3(3-0) S. The course involves a presentation of the mechanical and metallurgical fundamentals of metal machining. Topics to be discussed include: mechanics of machining, temperatures generated, tool life and tool wear, lubrication, grinding process, electrical machining processes, surface integrity, economics, nomenclature of cutting tools.

MAE 533 Finite Element Analysis of Mechanical and Aeronautical Systems I. Preq: MAE 472; Coreq: MAE 415. 3(3-0) S. Concepts and applications of the finite element method for stress and deformation analysis. Explanation and application of a general purpose finite element program for stress and deformation analysis of simple structures and load-carrying components.

MAE 534 Finite Element Analysis of Mechanical and Aeronautical Systems II. Preq: MAE 533. 3(3-0) F. This course extends the finite element study, initiated in MAE 533, for stress analysis to other fields of interest in mechanical and aerospace engineering. Topics considered include vibration and frequency analysis, heat transfer and potential flow. Two topics of advanced stress analysis, thin shells and the bending of plates, are also included.

MAE 535 Experimental Stress Analysis. Preq: MAE 316 or 371. 3(2-3) F. Theoretical and experimental techniques of strain and stress analysis with emphasis on electrical strain gages and instrumentation, brittle coatings, grid methods and an introduction to photoelasticity. Laboratory includes an investigation and complete report of a problem chosen by the student under the guidance of the instructor.

MAE 536 Photoelasticity. Preq: MAE 316 or 371. 3(2-3) S. Alt. yrs. Theory and experimental techniques of two- and three-dimensional photoelasticity including photoelastic coatings, photoplasticity and an application of photoelastic methods to the determination of stress-strain distributions in loaded members. Laboratory includes an investigation and complete report of a problem chosen by the student under the guidance of the instructor.

MAE 540 Advanced Air Conditioning Design. Preqs: MAE 403, 404. 3(3 0) F. Alt. yrs. The design of heating and air-conditioning systems; the preparation of specifications and performance tests on heating and air-conditioning equipment.

MAE 541 Advanced Machine Design I. Preq: MAE 416. 3(3-0) F. An advanced integrated treatment of stress analysis and materials engineering devoted to current rational methods of analysis and design applicable to mechanical components. Primary attention placed on the determination and prediction of strength, life and deformation characteristics of machine components as dictated by performance requirements.

MAE (OR) 545 Variational Methods in Optimization Techniques I. 3(3-0) Alt. F. (See operations research.)

MAE 550 Foundations of Fluid Dynamics. Preqs: MAE 301, MAE 355 or MAE 308. 3(3-0) F. Review of basic thermodynamics pertinent to gas dynamics. Detailed development of the general equations governing fluid motion in both differential and integral form. Simplification of the equations to those for specialized flow regimes. Similarity parameters. Applications to simple problems in various flow regimes.

MAE 551 Airfoil Theory. Preq: MAE 355. 3(3-0) S. Alt. yrs. Development of fundamental aerodynamic theory. Emphasis upon mathematical analysis and derivative of equations of motion, airfoil theory and comparison with experimental results. Introduction to supersonic flow theory.

MAE 552 Transonic Aerodynamics. Preq: MAE 356. 3(3-0) S. Alt. yrs. A detailed study of the latest theoretical and experimental findings in transonic aerodynamics, including two-dimensional and axisymmetric flows.

MAE 553 Compressible Fluids. Preq: MAE 356 or MAE 431 or MAE 550. 3(3 0) Alt. S. Equations of motion in supersonic flow. Prandtl-Meyer turns, method of characteristics, hodograph plane, supersonic wind tunnels, supersonic airfoil theory and boundary layer shock interaction.

MAE 554 Hypersonic Aerodynamics. Preq: MAE 356. 3(3-0) F. Alt. yrs. A detailed study of the latest theoretical and experimental findings in hypersonic aerodynamics.

MAE 555 Aerodynamic Heating. Preq: MAE 356. 3(3-0) F. Alt. yrs. A detailed study of the latest theoretical and experimental findings of the compressible laminar and turbulent boundary layers with special attention to the aerodynamic heating problem. Application of theory in the analysis and design of aerospace hardware.

MAE 556 Mechanics of Ideal Fluids. Preq: MAE 355 or MAE 308. 3(3-0) F.S. Fundamental principles of fluid dynamics. Mathematical methods of analysis are emphasized. Potential flow theory development with introduction to the effects of viscosity and compressibility. Two-dimensional and three-dimensional phenomena are considered.

MAE 557 Dynamics of Internal Fluid Flow. Preq: MAE 356 or MAE 308. 3(3-0) F. A general development of the governing equations of fluid motion with subsequent restriction to incompressible flow. Exact and approximate solutions of the Navier-Stokes equations for internal laminar flow and elementary boundary layer theory. Applications include: hydrodynamic lubrication, converging-diverging channel flows, entrance flows and turbulent internal flow.

MAE 558 Plasmagasdynamics I. Preqs: MAE 356, PY 414. 3(3-0) S. Alt. yrs. Study of basic laws governing plasma motion for dense and rarefied plasmas, hydromagnetic shocks, plasma waves and instabilities, simple engineering applications.

MAE 559 Molecular Gas Dynamics I. Preq: MAE 550. 3(3-0) F. Alt. yrs. Statistical mechanics as applied to the derivation of the equations of gas dynamics from the microscopic viewpoint. Collision processes, treatments of viscosity, heat conduction and electrical conductivity.

MAE (OY, MSE) 563 Geophysical Fluid Mechanics. 3(3-0) Alt. F. (See physical oceanography.)

MAE (EE) 565 Gas Lasers. Preqs: MAE 356 or equivalent, PY 407. 3(3-0) F. Alt. yrs. Study of the principles, design and potential applications of ion, molecular, chemical and atomic gas lasers.

MAE 570 Theory of Particulate Collection in Air Pollution Control. Preq: MAE 409 or grad. standing. 3(3-0) S. Particulate matter is classified and its properties are described. The motion of particles as applied to particulate collection is carefully analyzed. The elements of aerodynamic capture of particles are developed and applications in filtration and liquid scrubbing are considered. Fundamentals of acoustical, electrostatic and thermal precipitation are introduced. Sampling techniques and instrumentation are also considered.

MAE 586 Project Work in Mechanical Engineering. 1-6 F.S. Individual or small group investigation of a problem stemming from a mutual student-faculty interest. Emphasis is placed on providing a situation for exploiting student curiosity.

MAE 589 Special Topics in Mechanical Engineering. Preq: Advanced undergrad. or grad. standing. 3(3-0) F.S. Faculty and student discussions of special topics in mechanical engineering.

MATERIALS ENGINEERING

MAT 200 Mechanical Properties of Structural Materials. Preqs: CH 105 and the first course in engineering mechanics. 2(1-3) F.S. The dependence of mechanical properties of structural materials on macro-, micro- and crystalline structure; control of structure and properties through treatment. Staff

MAT 201 Structure and Properties of Engineering Materials. Preq: CH 105. 3(2-3) F.S. The fundamental physical principles governing the structure and constitution of metallic and nonmetallic materials of construction, and the relation of these principles to the control of properties. Staff

MAT 203 Orientation to Materials Engineering I. Preq: Sophomore standing in Materials Engineering. 1(0-2) F. A two-semester introductory course that emphasizes career opportunities, philosophy, objectives and scope of materials engineering as related to the needs of industry, government, education, the individual, and of society. Jordan

- MAT 204 Orientation to Materials Engineering II.** Preq: MAT 203. Intended for sophomores in Materials Engineering. 1(0-2) S. A two-semester introductory course that emphasizes career opportunities, philosophy, objectives and scope of materials engineering as related to the needs of industry, government, education, the individual, and of society.
Jordan
- MAT 301 Equilibrium and Rate Processes in Materials Science.** Coreq: MAE 301. 3(2-2) F. Application of thermodynamic and kinetic principles to engineering materials in the liquid and solid states.
Magor
- MAT 302 Materials Processing.** Preq: MAT 301. 3(3-0) S. Techniques for the processing of ceramic, metallic, and polymeric materials to control properties form, and appearance through considerations of thermal, chemical, mechanical, electrical, magnetic and nuclear energy. Both traditional and exotic processes are covered utilizing fundamental materials science and engineering science principles.
- MAT 310 Physical Examination of Materials.** Preq: MAT 320 or 200 or 201. 2(0-6) S. Experiments designed to demonstrate basic techniques in crystallography, x-ray diffraction, optical and electron microscopy, and thermal analysis.
Staff
- MAT 311 Ceramic Processing I.** Preq: MAT 201. 4(3-3) F. The basic chemical and physical laws underlying the processes and behavior of diverse ceramic compositions in the sequential manufacturing operations required to produce ceramic materials with controlled properties.
Harrell
- MAT 312 Ceramic Processing II.** Preq: MAT 311. 3(3-0) S. Basic principles underlying the thermal processing of ceramics. Appropriate subject materials in basic and engineering sciences with particular reference to obtaining desired microstructures.
Harrell
- MAT 320 Phase Diagrams and Crystallography.** Preq: MAE 301. 3(3-0) F. Applications of thermodynamic principles to the construction and use of phase diagrams in materials systems. Crystal structure of solids. Correlation of phase diagrams with microstructure.
Fahmy
- MAT 321 Phase Transformations and Diffusion.** Preq: MAT 320. 3(3-0) S. Introduction to mass transport and phase transformations in materials.
Benson
- MAT 400 Metallic Materials in Engineering Design.** Preq: MAT 200 or 201. 3(3-0) F.S. Relationship of microstructure to the properties of materials. Control of microstructure to meet engineering design requirements.
Moazed
- MAT 411 Physical Principles in Materials Science I.** Preq: MAT 321. 3(3-0) F. The application of physical concepts to ceramic, metallic and polymeric materials. Interaction of electromagnetic radiation with crystalline and non-crystalline materials. Relation of properties to structure.
Beeler
- MAT 417 Ceramic Subsystem Design.** Preq: MAT 312. 3(2-3) S. Individual and team study involving the interdependence of plant layout, processes, equipment and materials in the economic design of engineering systems and subsystems. Discussion of design principles, sources of data, creativity and economic analysis to encourage original solutions to engineering problems.
Harrell
- MAT 423 Materials Factors in Design I.** Preq: MAT 450. 3(1 6) S. Selection of materials for specific engineering applications. Manufacturing processes and their relation to product use.
Magor
- MAT 424 Materials Factors in Design II.** Preq: MAT 423. 3(3-0) F or S. Selection of materials for specific engineering applications. Manufacturing processes and their relation to product use.
Magor
- MAT 431 Physical Metallurgy I.** Preq: MAT 321. 3(2-3) F. Alloy design; control of properties through microstructures; principles of heat treatment, strengthening mechanisms.
Moazed
- MAT 432 Physical Metallurgy II.** Preq: MAT 431. 3(3-0) F.S. Alloy design; control of properties through microstructures; principles of heat treatment; strengthening mechanisms.
Staff

MAT 435 Physical Ceramics I. Preq: MAT 321. 3(2-3) F. The physicochemical nature of classical and newly discovered ceramic materials. Emphasis on thermodynamics, crystal structure, structural imperfections and non stoichiometry of ceramic compounds coupled with binary and multiphase equilibria. Effects of these parameters on properties. Davis

MAT 436 Physical Ceramics II. Preq: MAT 435. 3(2-3) S. The physicochemical nature of classical and newly discovered ceramic materials. Emphasis on thermal, mechanical, electrical and electronic properties of ceramic materials. Davis

MAT 437 Introduction to the Vitreous State. Preq: MAT 301. 3(3-0) S. The formation, structure, physical and chemical modifications of vitreous systems. Practical industrial calculations and the fabrication of glass. Catalyzed nucleation and crystallization of glasses in relation to physical properties. Davis

MAT 450 Mechanical Properties of Materials. Preq: MAT 200 or 201 or 310. 3(2-3) F. Elastic, plastic, and fracture phenomena in solids including yielding, strain hardening, fracture, creep and fatigue. Manning

MAT 491 Materials Engineering Seminar. Preq: Sr. standing. 1(1-0) F,S. Literature survey of selected MAT topics. Oral and written reports and discussions. Staff

MAT 493, 494 Ceramic Field Exercises I, II. Preq: Sr. standing. 1(0-3) F,S. Plant visitations, lectures by practicing ceramic engineers, reports on industrial organizations engaged in manufacture or use of ceramics. Discussions of professional organizations and ethics. Harrell

MAT 495 Materials Engineering Projects. Preq: Jr. or sr. standing. 1-6 F,S. Advanced engineering principles applied to a specific project dealing with metallurgy, materials or general experimental work. A seminar period is provided and a written report required. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

MAT 500 Modern Concepts in Materials Science. Preq: MAT 321. 3(3-0) F. Applications of current theories of materials such as crystal theory, continuum and quasi-continuum theories, phenomenological theories, etc., to the solution of materials problems. Staff

MAT 503 Ceramic Microscopy. Preq: GY 331. 3(2-3) F. Transmitted and reflected light techniques for the systematic study of ceramic materials and products. Staff

MAT 509 High Vacuum Technology. Preq: CH 433 or MAE 301. 3(2-3) F,S. Properties of low-pressure gases and vapors. Production, maintenance and measurement of high vacuum; design, construction and operation of high vacuum high temperature facilities. Properties and reactions of materials which are processed, tested and/or utilized in high vacuum environments. Staff

MAT 510 Structure of Crystalline Materials. Preq: MAT 411; Coreq: MAT 500. 3(3-0) F. The lattice structure of crystals, including group theory applications, reciprocal lattice concept and the study of crystal structure as related to bonding. Stadelmaier

MAT 520 Theory and Structure of Materials. Preq: MAT 510. 3(3-0) S. Structure of liquids, and crystalline and amorphous solids used in engineering systems. Crystallinity and thermal properties. Ionic crystals in ceramic systems. The metallic state and alloy behavior. Emphasis on the relation between fundamental materials parameters and engineering properties. Staff

MAT 527 Refractories in Service. Preq: MAT 411. 3(3-0) S. A study of the physical and chemical properties of the more important refractories in respect to their environment in industrial and laboratory furnaces. Staff

MAT 529 Properties of High Temperature Materials. Preqs: MAT 201 and MAE 301. 3(3-0) S. Effects of temperature on the physical, mechanical and chemical properties of inorganic materials; relationships between microstructure and high temperature properties; applications of ceramics, metals and composites at elevated temperatures. Staff

MAT 530 Phase Transformations in Materials I. Coreq: MAT 500. 3(3-0) S. Kinetic theory of transformations, nucleation theory, homogeneous and heterogeneous nucleation, growth of crystals, epitaxial thin films. Moazed

MAT (MAE) 531 Materials Processing by Deformation. 3(3-0) F. (See mechanical and aerospace engineering.)

MAT (MAE) 532 Fundamentals of Metal Machining Theory. 3(3-0) S. (See mechanical and aerospace engineering.)

MAT 533, 534 Advanced Ceramic Engineering Design I, II. Preq: MAT 417. 3(2-3) F,S. Advanced studies in analysis and design of ceramic products, processes and systems leading to original solutions of current industrial problems and the development of new concepts of manufacturing. Palmour

MAT 540 Glass Technology. Preq: MAT 437. 3(3-0) F. Fundamentals of glass manufacture including compositions, properties and application of the principal types of commercial glasses. Davis

MAT 541, 542 Principles of Corrosion I, II. Preqs: MAT 201 and CH 431 or MAE 301. 3(2-3) F,S. The fundamentals of metallic corrosion and passivity. The electrochemical nature of corrosive attack, basic forms of corrosion, corrosion rate factors, methods of corrosion protection. Laboratory work included. Manning

MAT 550 Dislocation Theory. Preq: MAT 450. 3(3-0) F. Structure, energetics, stress and strain fields, interactions and motion of dislocations in solids. Staff

MAT 556 Composite Materials. Preq: MAT 450. 3(3-0) F. Basic principles underlying the properties of composite materials as related to properties of the individual constituents and their interactions. Emphasis on the design of composite systems to yield desired combinations of properties. Fahmy

MAT (NE) 562 Materials Problems in Nuclear Engineering. Preq: Advanced undergrad. standing. 3(3-0) F. Reactor design and operating considerations determined by materials properties are covered. Emphasis on the interrelations among materials, compatibility effects, corrosion effects and radiation effects in fission and fusion reactors. Staff

MAT (NE) 573 Computer Experiments in Materials and Nuclear Engineering. Preq: Advanced undergrad. standing. 3(3-0) S. Monte Carlo and dynamical computer experiments are covered from the standpoint of how to design and use them in materials and nuclear engineering work. Beeler

MAT 595 Advanced Materials Experiments. Preq: Sr. or grad. standing. 1-3. Advanced engineering principles applied to a specific experimental project dealing with materials. A seminar period is provided and a written report is required. Staff

MICROBIOLOGY

MB 401 General Microbiology. Preqs: BS 100, CH 223 or 220. 4(3-3) F,S. Rigorous introduction to basic principles and concepts of microbiology. Recommended for students in biological and agricultural sciences curricula and for all students planning to take further courses in microbiology. Luginbuhl, Melton

MB (FS) 405 Food Microbiology. Preq: MB 401. 3(2-3) F. (See food science.)

MB 411 Medical Microbiology. Preq: MB 401. 4(3-3) S. A comprehensive study of the processes by which pathogenic microorganisms cause disease and the biological defense mechanisms by which the host resists. Methods of diagnosis, prevention and therapy of common diseases of microbial origin will be considered. The laboratory will introduce the student to the general techniques of clinical bacteriology, immunology and virology. Luginbuhl

MB 490 Special Studies in Microbiology. Preq: Three courses in microbiology and CL 1-3 F,S,Sum. Undergraduate students will be given an opportunity to participate in the current research program of a faculty member or to participate in a special study of an advanced undergraduate topic. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

MB 501 Advanced Microbiology. Preq: MB 401. 3(3-0) F. A study in some depth of

microbial structure and function, microbial ecology and characterization of important groups of microorganisms. Perry

MB (FS) 506 Advanced Food Microbiology. 3(1-6) S. (See food science.)

MB 514 Microbial Metabolism. Preqs: MB 401, BCH 351 or BCH 551. 3(3-0) S. A study of the physiology and metabolism of microorganisms and their regulatory mechanisms. Dobrogosz

MB (SSC) 532 Soil Microbiology. 4(3-3) S. (See soil science.)

MB 551 Immunology I. Preq: MB 401. 3(2-2) F. A concise study of the basic concepts and principles in immunology and serology. Primary emphasis will be on humoral immunity involving soluble blood and lymph components important in the resistance of the host to disease. Lecce

MB (PO, PHY, VET) 552 Immunobiology. 3(3-0) S. (See poultry science.)

MB (ZO) 555 Protozoology. 4(2-6) S. (See zoology.)

MB (BCH, GN) 561 Biochemical and Microbial Genetics. 3(3-0) S. (See biochemistry.)

MB (BAE CE) 570 Sanitary Microbiology. 3(2-3) S. (See civil engineering.)

MB 571 Virology. Preqs: BCH 551, MB 401. 3(3-0) F. An introduction to the fundamental aspects of virus-cell interactions. These include virus attachment and penetration, intracellular virus replication, metabolic changes occurring in cells as a result of virus infection and virus-induced cellular transformations. Johnston

MB (BO) 574 Phycology. 3(1-4) S. (See botany.)

MB (BO, PP) 575 The Fungi. 3(3-0) F. (See botany.)

MB (BO, PP) 576 The Fungi—Lab. 1(0-3) F. (See botany.)

MILITARY SCIENCE (ARMY ROTC)

(Also see Aerospace Studies)

MS 101 Introduction to ROTC and the Army. 1(1-0) F. The mission and organization of the U. S. Army and an introduction to Army ROTC. Advantages, opportunities and benefits of becoming an officer in the Army are examined and discussed. Practical work in marksmanship and other skills such as rappelling is emphasized. Cox

MS 102 Introduction to Leadership and Management. 1(1-0) S. A seminar approach which investigates current topics of interest to the Army. Instruction and practical work in the fields of leadership and management. Cox

MS 103 Ranger/Special Forces Operations. 1(1-0) F. An introduction to the Army Ranger and Special Forces Programs. Their histories, philosophies, and objectives, and various techniques and methods employed by each. Cox

MS 104 Military Physical Training. 1(1-0) S. An introduction to various military physical training programs, to include conditioning drills, grass drills, drownproofing, and team contests. An opportunity to measure the individual's physical condition against rigid Army standards is also offered. Cox

MS 105 Army Aviation. 1(1-0) F.S. A survey of the Army Aircraft inventory with a discussion of the capabilities, limitations, and employment of Army Aviation assets. Closely associated subjects covered include fixed and rotary-wing categories of aircraft and their peculiar principles of flight, and the effect of weather and terrain upon aviation operations. The course includes a five-hour classroom practical exercise in airmobile operations. Cox

MS 203 Survival Techniques. Preq: MS 101 or equivalent. 1(1-0) F. An introduction to basic survival techniques on land and in water. Emphasis is upon those survival situations which may be encountered in outdoor activities. Students will be exposed to survival skills and techniques unique to tropical, cold weather, and desert climates. Rowley

MS 204 Basic Small Unit Tactics. Preq: MS 101 or equivalent. 1(1-0) S. The course will integrate small-unit tactics and principles of leadership. Applicability will be not only to the

student pursuing a military commission but the principles taught will be useful in a variety of managerial positions in the civilian community as well.

Rowley

MS 205 Fire Support Coordination. Preq: MS 101 or equivalent. 1(1-0) F. An introduction to the Army's fire support agencies. The course will provide the student with a basic understanding of the methods of target acquisition. In addition, the student will be exposed to the gunnery hardware used by a fire support agency.

Rowley

MS 206 Map Reading. Preq: MS 101 or equivalent. 1(1-0) S. An introduction to basic map reading techniques, to include how to determine present location through the use of intersection and resection procedures. The course will provide useful information for outdoor activities, ranging from competitive orienteering to occasional backpacking.

Rowley

MS 303 Land Navigation Techniques. Preq: MS 204 or equivalent. 1(1-0) F. Instruction in land navigational techniques to include a review of basic map reading. Subjects which receive particular emphasis are night navigation and military orienteering.

Kehoe

MS 304 Intermediate Small Unit Tactics. Preq: MS 204 or equivalent. 1(1-0) S. The course includes planning, organizing, and executing military operations at the Small Unit level. The rifle platoon is used as a vehicle for analysis.

Kehoe

MS 305 Application of Military Leadership and Management Techniques. Preq: MS 204 or equivalent. 1(1-0) F. Instruction is in the application of military leadership and management techniques utilizing both the case-study and the seminar approach. Subjects which receive emphasis are the individual, the group, the situational variables.

Kehoe

MS 306 Effective Means of Military Communication. Preq: MS 204 or equivalent. 1(1 0) S. Instruction is in the principles of communication skills to include the proper preparation and conduct of military instruction. The students are required to give a short oral presentation to their peers.

Kehoe

MS 403 Law for the Military Officer. Preq: MS 306 or equivalent. 1(1-0) F. An advanced level Military Science Course dealing with the evolution of the military justice system. The course offers an understanding of the Army platoon leader's role in the administration of military justice, to include his/her authority and responsibility and the protection of the rights of the individual soldier. The Geneva/Hague Conventions and the Code of Conduct for the Armed Forces are also addressed.

Covington

MS 404 American Military History. Preq: MS 306 or equivalent. 1(1-0) S. An advanced level Military Science Course designed to give the student a basic appreciation of the historical development of the US Army and its role in support of national objectives. Emphasis is placed on the central importance of leadership in determining the outcome of war and on the effect of technology upon military tactics.

Covington

MS 405 Advanced Small Unit Tactics. Preq: MS 304 or equivalent. 1(1-0) F. An advanced-level Military Science Course designed to further the student's understanding of military tactical operations at the Small Unit level. The course covers the coordination and planning between the elements of a military team, the junior officer's role within the team, and the impact of detailed planning on the success of tactical operations.

Covington

MS 406 Personal Affairs Management for the Military Officer. Preq: MS 306 or equivalent. 1(1-0) S. An advanced-level Military Science course designed to give the student an understanding of military life, to include career opportunities, obligations, and responsibilities for Army Officers. Students are shown the practical aspects of life as an Army Officer in order to enhance their smooth transition to active Army service or service with the Reserve components.

Covington

MS 495 Special Topics in Military Science. 1(1-0) F,S. A general course offered as needed to treat new or special subject matter in Military Science.

Staff

MARINE SCIENCE AND ENGINEERING

MSE 200 Introduction to the Marine Environment. 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.

MSE (MAE) 471 Undersea Vehicle Design. Preq: MAE 355 or MAE 308. 3(3-0) Alt. yrs. (See mechanical and aerospace engineering.)

Selected 500-Level Courses Open To Advanced Undergraduates

MSE (MY) 526 Air-Sea Interaction. 3(3-0) Alt. F.S. (See meteorology.)

MSE (ZO) 529 Biological Oceanography. 3(3-0) F. (See zoology.)

MSE (CE) 541 Gravity Wave Theory I. Preq: MAE 308 or PY 411. 3(3-0) S. Classical gravity wave theory with emphasis on the basic mechanics of wave motions, mass transport induced by waves and various conservation laws with their applications in wave study.

Weisberg

MSE 551 Ocean Circulation. Preq: MAE 308 or PY 411. 3(3-0) S. Basic study of the mechanics of ocean circulation with emphasis on various simple models of circulation systems.

Pietrafesa

MSE 560 Principles of Physical Oceanography. Preqs: MA 212 and PY 212 or equivalent. 3(3-0) F. An introduction to the principles and practice of physical oceanography. Subjects to be covered include: the equation of state of seawater; energy transfer to the ocean by thermal, radiative and mechanical processes; the heat budget; oceanic boundary conditions, the geographical distribution of oceanic properties; observational methods; conservation equations; simple waves and tides; physical oceanography of the North Carolina coastal zone.

Weisberg

MSE (MAE) 563 Geophysical Fluid Mechanics. Preq: MAE 550 or equivalent. 3(3-0) Alt. F. The principles of fluid mechanics are applied to geophysical systems. Special emphasis is placed on those features of these systems, such as almost rigid rotation, and stable stratification, which produce unique and important effects. The effects of almost rigid rotations on homogeneous and stratified flows are examined in detail. (Offered 1979-80 and alt. years.)

Janowitz

MSE (CE) 581 Introduction to Oceanographic Engineering. 3(3-0) S. (See civil engineering.)

MSE (GY) 584 Marine Geology. 3(3-0) S. (See geology.)

MSE 591, 592 Marine Sciences Seminar. 1(1-0) F.S. A seminar designed to give perspective in the field of marine science. Topics vary from semester to semester. In order to obtain credit a student must deliver a seminar.

MUSIC

MUS 100 Instrumental Music. Preq: Satisfactorily passing audition. 1(0-5) F.S. The performance and study of the best in instrumental music. Assignments to various organizations made according to instrument played and individual interests and abilities.

MUS 110 Choral Music. Preq: Satisfactorily passing audition. 1(0-4) F.S. The performance and study of the best in choral music. Assignments to various organizations made according to individual interests and abilities.

MUS 200 Understanding Music. 3(3-0) F.S. To assist students in developing understanding and comprehension of music heard today. Emphasis is upon evaluating musical elements and content, form, style periods, and design.

MUS 210 A Survey of Music in America. 3(3-0) Alt. yrs. A historical survey of music in the United States from colonial times to the present, with emphasis on the major influences which have shaped the musical literature of America. The objective of the course is to develop an awareness and understanding of the indigenous musical forms and styles and of the role this music has played in the development of the important cultural traditions of the United States.

MUS 215 Music of the 17th and 18th Centuries. 3(3-0) Alt. yrs. Examine selected European music from 1600 to 1800, emphasis on concepts of compositional style, reflections of certain broad cultural tendencies and purely musical phenomena. Study of specific forms and genres as they evolved during this period.

MUS 220 Music of the 19th Century. 3(3-0) Alt. yrs. Course designed to provide an insight into the significant musical forms of the western world in the 19th century. Subject matter will include an analysis of the musical literature of the prevailing forms, its composers and the relation of music to other art forms of the time period.

MUS 301 Basic Music Theory I. 3(3-0) F,S. Introductory course for students with no formal musical background. Basic elements of music. Exercises in notation, ear training, written harmony, and the application through a study of selected compositions from the musical literature.

MUS 302 Basic Music Theory II. Preq: MUS 301, CI. 3(3-0) F,S. Continuation of MUS 301. Musical analysis of representative works. Further study of chordal functions through written exercises. Compositions written by students using as a model a piece from the standard musical literature which employs principles studied throughout the course.

MUS 320 Music of the 20th Century. 3(3-0) Alt. yrs. Traditions and innovations in representative music of this century are examined. Emphasis upon musical ideas and materials.

MUS 401 Music Composition I. Preq: MUS 301 or 302 or CI. 3(3-0) F. Writing course designed to provide non-music majors experience in creating their own musical compositions. Students will learn basic skills in manipulating musical materials which include harmonic, melodic, rhythmic, and contrapuntal characteristics of all periods of music.

MUS 402 Music Composition II. Preq: MUS 401 or CI. 3(3-0) S. Emphasis on 20th century compositional techniques. Study and construction of larger musical phrases and forms and the harmonic and contrapuntal principles employed within their construction. Study in techniques of orchestration.

MUS 495 Special Topics in Music. 1-3 F,S. Offered to focus on new or special subject matter not covered by existing courses.

METEOROLOGY

MY 201 Atmospheric Environment. Preq: High school physics, chemistry, algebra, trigonometry, or equivalent. 3(3-0) F,S. Nature and processes of the atmosphere, interactions with land, sea, and life at the surface, relations to other components of the solar system; measurements and surveillance of the atmosphere and relations to climatology, weather forecasting, weather modification and air pollution, and applications to various human activities.

MY 311 Physical Climatology. Preqs: MA 201, PY 205, or equivalent. 3(3-0) F. Physical basis for weather and climates on earth, approached from the principles of physical climatology. Topics include solar energy (incident to and modified by the atmosphere), terrestrial radiation, fluxes of heat and water substance, heat balances, and their consequences in distributions of temperature, mass (pressure), motions, and weather of the atmosphere. Saucier

MY 335 Weather Systems and Information. Preqs: MA 102 or 112, PY 205 or 212 or 221. 2(1-3) F. Purposes served by atmospheric information in human endeavors; observation, measurement, processing, and communication of meteorological data; construction and interpretation of weather and climate charts; weather systems and processes; applications of weather and climate information. Riordan, Watson

MY 336 Meteorological Laboratory I. Coreqs: MA 202, MY 335. 1(0-3) F,S. A laboratory course applying and interpreting essential mathematical-physical concepts in geophysical time and space distributions obtained from networks of observations. Watson

MY 386 Climate Near the Ground. Preq: MA 112, PY 221. 3(3-0) S. Analysis of basic physical states and processes at the interface of atmosphere with land surfaces and vegetation in terms of the meteorological controls. Designed to serve needs in the various plant sciences. Riordan

MY 412 Atmospheric Physics. Preq: MY 311 or CI. 3(3-0) S. Atmospheric effects on electromagnetic and acoustic transmission and the consequent phenomena; terrestrial radiation; radar meteorology, visibility, atmospheric electricity and magnetism.

MY 421 Air Properties and Processes. Preqs: MA 202, PY 208. Coreq: MY 336. 3(2-2) F. The variables of composition and state, and the processes of air, in the atmospheric system, including heat and moisture transfers and water phase changes, analyzed from the governing laws of physics; hydrostatics, altimetry, stability; introduction to convective-diffusive exchanges. Saucier

MY 422 Atmospheric Motions. Preqs: MA 202, PY 208, Coreq: MY 336. 3(2 2) F. Properties and fields of atmospheric motion, variations with time including linear and angular momentum, divergence, and deformation; momentum transfer and forces, equation of motion, observed wind versus theoretical winds; wind structure in the friction layer. Tsui

MY 441 Meteorological Analysis I. Preqs: MY 421, 422. 3(3-0) S. Analysis of stability, convection, diffusion, advection, and surface transfers in the modification of atmospheric states and in weather processes; continuity, pressure tendency, and vorticity theorems, and their roles in the motion fields; geostrophic and accelerated motions; analysis of distributions and processes in x, y, z, t from governing laws and conditions. Saucier

MY 443 Meteorological Laboratory II. Coreq: MY 441. 3(0-9) S. Analysis of atmospheric distributions, processes and developments, from operational meteorological data and the principles presented in prerequisite and corequisite courses. Student gains working knowledge of integrated atmospheric systems and processes through detailed analyses of natural situations. Saucier

MY 444 Weather Forecasting Principles. Preq: MY 443. 3(2-3) F. Principles and operations of weather forecasting including dynamical extrapolation, statistical approaches, basics of numerical weather prediction, NWS models, trajectory forecasts, model output statistics, severe weather and other short range forecasts, forecast preparation and verification. Watson

MY 455 Micrometeorology. Preq: MY 422 or MAE 402. 3(3-0) F. The energy balance at the earth's surface; soil heat flux and temperature profiles. Vertical distributions of wind, temperature and humidity in the atmospheric surface layer; exchanges of momentum, heat and moisture between the earth and the atmosphere; agricultural and forest micrometeorology. Arya

MY 493 Special Topics in Meteorology. Preq: Consent of department. 1-3 F,S,Sum. 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

MY 521 The Upper Atmosphere. Preq: MY 411 or CI. 3(3-0) S. Meteorological conditions in the upper atmosphere from the stratosphere to the ionosphere. Compositions, mean distributions and variabilities, and circulation and transport properties in the region. Physical theories. Watson

MY 524 Dynamic Meteorology. Preq: MY 422. 3(3-0) F. Brief review of the classical and physical hydrodynamics; scale analysis of dynamic equations; atmospheric instabilities; dynamics of tropical convections; perturbation theory and approximations for atmospheric wave motions. Tsui

MY 525 Numerical Weather Prediction. Preqs: MY 524, CSC (MA) 427 or equivalent and some FORTRAN programming experience. 3(3-0) S. Physical and mathematical basis of numerical weather prediction with computer experiments to demonstrate principles and techniques. Topics include deviation of sets of prediction equations consistent with scale analysis and dynamical constraints; atmospheric waves and filtered equations; numerical methods and computational instabilities; filtered and primitive equation models; NWS operational models. Watson

MY (MSE) 526 Air-Sea Interaction. Preq: MY 422 or MSE 560 or CI. 3(3-0) Alt. F,S. Review of basic equations and concepts of turbulent transfer in geophysical flows, air-sea interaction processes and their importance to man's activities, theory and observation of wind-generated ocean surface waves, turbulent transfers in the planetary boundary layer of the marine atmosphere, oceanic mixed layer, development of thermocline and inversion. Arya

MY 527 Planetary Boundary Layer. Preq: MY 455 or MY 526 or CI. 3(3-0) Alt. F.S. Review of the basic equations and concepts of planetary boundary layers. Study of the closure problem and semiempirical theories of turbulence, buoyancy effects on mean flow and turbulence, instrumentation and observational platforms for PBL experiments, observed characteristics of atmospheric boundary layers, numerical and physical modeling of PBL, and its parameterization in large-scale atmospheric circulation models. Arya

MY 555 Meteorology of the Biosphere. Preqs: PY 205 or 211; CH 103 or 107; MA 102 or 112. 3(3-0) F. A course designed for graduate students in the life sciences, presenting the physical principles governing the states and processes of the atmosphere in contact with earth's surface of land, water, and life. Exchanges of heat, mass, and momentum are analyzed for various conditions of the atmosphere and surface, and as a function of season, time, and geographic location. Riordan

MY 556 Air Pollution Meteorology. Preqs: MA 201 or 212, PY 208 or 212, CH 103 or 105 or 107 or equivalent. 3(3 0) F. Wind structure in the atmospheric surface layer and planetary boundary layer; temperature structure and stability; mixed layer and inversions; turbulence intensity and scale; meteorological factors affecting the dispersion of pollutants; diffusion theories and models; diffusion and transport experiments; plume rise, fumigation and trapping; removal processes; effects of buildings and hills; effects of local winds. Arya

MY 593 Advanced Topics. Preq: CI. 1 6 F.S. Special topics in meteorology, provided to groups or to individuals. Graduate Staff

NUCLEAR ENGINEERING

NE 201 Applications of Nuclear Energy. Preq: PY 208. 3(3 0) S. An elementary introduction to nuclear energy. Topics include radioactivity, fission and fusion, power production, isotopes, radiation detection, radiation safety, environmental effects and energy resources. The student is given a broad perspective of nuclear engineering and introduced to both fundamentals and applications. Staff

NE 302 Fundamentals of Nuclear Engineering. Preqs: NE 201, PY 410. 4(3-2) F. An introductory course in nuclear engineering. 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. Stam

NE 401 Reactor Analysis and Design. Preq: NE 302 or 419. 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. Stam

NE 402 Reactor Engineering. Preq: NE 302 or 419. 4(3-2) F. Engineering topics pertinent to the design of reactors are stressed, including heat transfer and fluid flow in reactors, relevant computer codes, power plant thermodynamics, and shielding. Laboratory experiments are included. Verghese

NE 403 Nuclear Engineering Design Projects. Preq: 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. Murray

NE 404 Radiological, Reactor, and Environmental Safety. Preq: NE 302 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, 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. Elleman, Kohl, Zumwalt

NE 405 Reactor Systems. Preq: NE 402. 3(3-0) S. Nuclear power plant systems, their design criteria, design parameters, and economics. Topics covered include: PWR, BWR, HTGR, their primary loops, auxiliary and emergency systems; containment; radwaste handling; reactor control systems and reactor operation; quality assurance; cost components of nuclear power. Bohannon

NE 412 Nuclear Fuel Cycles. Preq: NE 302. 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; burn-up calculations and design of reload cores; plutonium and thorium utilization. Verghese

NE 414 Nuclear Power Plant Instrumentation. Preqs: NE students: EE 331, 332; EE students: NE 419. 3(3-0) S. Treats the instrumentation required for control and safety of a nuclear power plant. The dynamic behavior of a nuclear plant is 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 are discussed. Protection against loss-of-power, lightning, etc. are treated. Saxe

NE 419 Introduction to Nuclear Engineering. Preq: PY 202 or 208. Not open to undergraduate majors in Nuclear Engineering. 3(3-0) F.S. Nuclear energy applications, including nuclear reactor materials, reactor theory, shielding, thermal and hydraulic analysis, and control. Uses of nuclear fission and its by-products in research, industry and propulsion. Major engineering problems are defined and methods of approach outlined. Course designed for students not majoring in Nuclear Engineering. Staff

NE 491, 492 Nuclear Engineering Topics I, II. Preq: CI. Variable credit. 1-4 F.S. Detailed coverage of special topics. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

NE 501 Radiation and Reactor Fundamentals. Preq: MA 401; Coreq: NE 419. 4(3-3) F. An introduction to fundamentals of reactor physics, nuclear radiation, and radiation interactions. Topics include radiation interaction with matter, radiation detection, neutron and reactor physics, neutron slowing down, one-group and two-group criticality for bare and reflected reactors, and radiation shielding. Laboratory experiments in radiation detection and attenuation are included. Stam

NE 502 Nuclear Engineering Analysis. Preqs: NE 401 or NE 501, MA 401. 3(3-0) S. Provides a unified view of the basic equations and techniques of radiation transport calculations. The course introduces the common analytical and numerical solution techniques used in nuclear engineering and develops solutions for typical problems in the nuclear field. The course is intended to provide the background in analysis needed for more advanced studies in nuclear engineering. Dunn, Gardner, Murray

NE 503 Reactor Analysis. Preqs: NE 401 or NE 501; MA 401. 2(2-0) F. Provides the basic theory of neutron motion and methods for finding neutron flux distributions in a nuclear reactor. Neutron slowing, resonance absorption, thermalization, and diffusion in reactor components are emphasized. With the knowledge of the contents of the course students can read the literature, perform analysis, and do calculations. Murray

NE 504 Reactor Heat Transfer. Preq: NE 501. 2(2-0) S. Considers heat generation and transfer in nuclear power reactors. Topics include reactor heat generation, steady-state heat flow in fuel elements, unsteady-state heat transfer, convective heat transfer coefficients for turbulent flow, boiling and two-phase flow, reactor system descriptions and reactor economics. Verghese

NE 505 Reactor Dynamics and Control. Preq: NE 401 or NE 501. 2(2-0) F. Considers the time dependent behavior of nuclear reactors and their control. Topics include time dependent, one speed diffusion equation, point reactor kinetics, solutions for ramp insertions of reactivity, temperature and void coefficients, feedback in power excursions, feedback analysis reactor transfer functions, determination of transfer functions, digital reactivity meters, and space dependent reactor dynamics. Saxe

NE 506 Radioisotopes Measurement Applications. Preqs: MA 401, NE 501. 2(2-0) S. Introduces the student to measurement application using radioisotopes. In addition to surveying all tracer and gauging applications and radiography, four major specific applications in gauging and tracing are treated in detail. Gardner

NE 507 Radiation Effects. Preq: NE 401 or NE 501. 2(2 0) F. Introduces the student to radiation effects on organic materials, metals, and inorganic solids with particular emphasis on nuclear reactor fuels. Applications of radiation effects such as sterilization and polymerization are discussed as well as the implications of radiation damage to reactor materials. Zumwalt

NE 508 Radiation Safety. Preq: NE 501. 2(2-0) S. Presents the basic concepts of health physics, biological effects of radiation, and calculation of radiation exposure. Methods of dose reduction are considered with particular emphasis on radiation shielding. Topics include: radiation units, allowable radiation exposures, dose calculations external and internal, radiation dosimetry, reactor radiation sources and shielding. Elleman

NE 510 Nuclear Design Calculations. Preq: NE 401 or NE 501. 3(3-0) S. Application of the digital computer to problems in nuclear engineering. Available nuclear engineering computer modules are studied and exercised. Systems and programs used by industry for power reactor design and operation are described. A review of relevant numerical methods facilitates computer program development by the students. Students do literature studies, a term project, and give oral reports. Murray

NE (PY) 511 Nuclear Physics for Engineers. 3(3-0) F. (See physics.)

NE 514 Principles of Fusion Reactors. Preqs: NE 503, NE 507. 3(3-0) S. Provides an introduction to plasma concepts and fusion reactor design. Topics include: basics of thermonuclear reactions, plasma confinement, formation and heating of plasmas, reactor concepts and designs, materials problems, and environmental effects. Saxe, Elleman, Verghese

NE (MAT) 562 Materials Problems in Nuclear Engineering. 3(3 0) F. (See materials engineering.)

NE (MAT) 573 Computer Experiments in Materials and Nuclear Engineering. Preq: Advanced undergrad. standing. 3(3 0) S. Monte Carlo and dynamical computer experiments are covered from the standpoint of how to design and use them in materials and nuclear engineering work. Beeler

NE (CE) 574 Environmental Consequences of Nuclear Power. Preq: CI. 3(3-0) S. Evaluation of environmental consequences resulting from electrical power generation, with emphasis on siting, construction, and operation of nuclear power plants. Topics include: growth in electrical demand, alternative sources of power and their environmental aspects; fuel reprocessing; sources and treatment of solid, liquid, and gaseous wastes; sources and effects of waste heat; federal and state regulations, including Environmental Impact Statements. Kohl, Zumwalt, Smallwood

NE 591, 592 Special Topics in Nuclear Engineering I, II. Preq: CI. 3(3-0) F,S. Graduate Staff

NUTRITION

NTR (ANS, FS) 301 Nutrition and Man. Preq: Two years of college work. 3(3 0) F,S. Basic principles relating to practical problems in the provision and utilization of nutrients for individuals and populations under various environmental conditions. McNeill

NTR (ANS, PO) 415 Comparative Nutrition. Preq: CH 220 or 221. 3(3 0) F. (See animal science or poultry science.)

NTR 490 Nutrition Seminar. Preq: Sr. standing. 1 F,S. Reviews, analysis and discussions of information and proposals relating to problems in human nutrition and allied areas.

Selected 500-Level Courses Open To Advanced Undergraduates

NTR (ANS) 516 Quantitative Nutrition. Preq: BCH 351 or NTR (ANS) 415 or CI. 3(1-6) S. The quantitative evaluation of dietary ingredients of foods and feeds and determination of

utilization of nutrients. Exploration of the application of quantitative principles of nutrition through the use of laboratory animals and microorganisms.

Armstrong

NTR 590 Topical Problems in Nutrition. Preq: Grad. or sr. standing. 1-6 F,S. Analysis of problems of current interest in nutrition. Credit for this course will involve the scientific appraisal and solution of a selected problem. The problems will be designed to provide training and experience in research.

Graduate Staff

OPERATIONS RESEARCH

OR 493 Special Topics in Operations Research. Preqs: Junior or senior standing; MA 112. 1-3 F,S,Sum. Directed readings, problem sets, written and oral reports at an introductory level as indicated by need and interest of student.

Staff

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,Sum. OR Approach: modeling, constraints, objective and criterion. The problem of Multiple criteria. Optimization. Model validation. The team approach. Systems Design. Examples, OR Methodology: mathematical programming; optimum seeking; simulation, gaming; heuristic programming. Examples. OR Applications; theory of inventory; economic ordering under deterministic and stochastic demand. The production smoothing problem; linear and quadratic cost functions. Waiting line problems: single and multiple servers with Poisson input and output. The theory of games for two person competitive situations. Project management through PERT CPM.

Elmaghraby, Lee

OR (IE, MA) 505 Mathematical Programming I. Preq: MA 405. 3(3-0) F,Sum. A study of mathematical methods applied to problems of planning. Linear programming will be covered in detail. This course is intended for those who desire to study this subject in depth and detail. It provides a rigorous and complete development of the theoretical and computational aspects of this technique as well as a discussion of a number of applications.

Lee, Reiland

OR 506 Algorithmic Methods in Nonlinear Programming. Preqs: MA 301, MA 405, knowledge of computer language, such as FORTRAN or PL1. 3(3-0) F Alt. yrs. Introduction to methods for obtaining approximate solutions to unconstrained and constrained minimization problems of moderate size. Emphasis on geometrical interpretation and actual coordinate descent, steepest descent, Newton and quasi-Newton methods, conjugate gradient search, gradient projection and penalty function methods for constrained problems. Specialized problems and algorithms will be treated as time permits.

Reiland

OR (IE) 509 Dynamic Programming. Preqs: MA 405, ST 421. 3(3-0) S. An introduction to the theory and computational aspects of dynamic programming and its application to sequential decision problems.

Elmaghraby, Nuttle

OR 520 Theory of Activity Networks. Preqs: OR 501 OR (IE, MA) 505. 3(3-0) S Alt. yrs. Introduction to graph theory and network theory. A discussion in depth of the theory underlying (1) deterministic activity networks (CPM): optimal time-cost trade offs; the problem of scarce resources; (2) probabilistic activity networks (PERT): critical evaluation of the underlying assumptions; (3) generalized activity networks (GERT, GAN): applications of signal flow graphs and semi-Markov process to probabilistic branching; relation to the theory of scheduling. (Offered in alt. years.)

Elmaghraby

OR (IE) 522 Organizational Systems Dynamics. Preqs: ST 371, IE 421. 3(3-0) F. A study of the behavior of large organizations as simulated on a large digital computer and driven by suitable exogeneous inputs. Basic theory of feedback control of systems; methods of modeling for continuous simulation, including aspects of management policy. Projects cover study, modeling and simulation of industrial, business, political social organizations and systems; methods of changing system behavior by modifying parameters and model structure.

Llewellyn

OR (CHE) 527 Optimization of Engineering Processes. Preqs: CHE 451 or OR 501, FORTRAN programming. 3(3-0) S Alt. yrs. The formulation and solution of process optimization problems, with emphasis on nonlinear programming techniques. Computer im-

plementation of optimization algorithms, and structuring of process models to increase computational efficiency.

Felder

OR (E) 531 Dynamical Systems and Multivariable Control. Preqs: MA 301, 405 or equivalent. 3(3-0) F. Introduction to analytical modeling, control and optimization of dynamical systems based on state space and transfer function descriptions. Emphasis on linear, continuous-time and discrete-time systems. Topics include state variables, transforms, flow graphs, canonical forms, system response, stability, controllability and observability, modal control, non-interacting control, observers, fundamental concepts of optimal control and estimation. Multidisciplinary applications chosen from biological, chemical, economic, electrical, mechanical and sociological systems.

Gruver, Lee

OR (MAE) 545 Variational Methods in Optimization Techniques I. Preqs: MA 511, MA 512. 3(3-0) F Alt. yrs. Variational methods are applied to optimization problems in engineering, where examples are drawn from flight mechanics, operations research, heat transfer, structures and aerodynamics. The necessary conditions which follow from the general variation of a functional are developed. Solutions with corners and discontinuities are considered. Inequality constraints on control variables and constrained extrema are also considered. Gradient methods are described.

Maday

OR (IE) 561 Queues and Stochastic Service Systems. Preq: MA 421. 3(3-0) F. General concepts of stochastic processes are introduced. Poisson processes, Markov processes, and renewal theory are presented. These are then used in the analysis of queues, starting with a completely memoryless queue to one with general parameters. Applications to many engineering problems will be considered.

Stidham

OR (CSC, IE) 562 Advanced Topics in Computer Simulation. 3(3-0) S. (See computer science.)

OR (CSC, MA) 585 Graph Theory. Preqs: MA 231 or 405. 3(3-0) F. Basic concepts of graph theory. Trees and forests. Vector spaces associated with a graph. Representation of graphs by binary matrices and list structures. Traversability. Connectivity. Matchings and assignment problems. Planar graphs. Colorability. Directed graphs. Applications of graph theory with emphasis on organizing problems in a form suitable for computer solution.

Gardner

OR (IE, MA) 586 Network Flows. Preq: OR (IE, MA) 505 or equivalent. 3(3-0) S. This course will study problems of flows in networks. These problems will include the determination of the shortest chain, maximal flow and minimal cost flow in networks. The relationship between network flows and linear programming will be developed as well as problems with nonlinear cost functions, multi-commodity flows, and the problem of network synthesis. (Offered in alt. years.)

Gardner, Lee

OR 591 Special Topics in Operations Research. Preq: CI. 1-3 F,S. Individual or small group studies of special areas of OR which fit into the students' programs of study and which may not be covered by other OR courses. Furthermore, the course serves as a vehicle for introducing new or specialized topics at the introductory graduate level.

Graduate Staff

PRODUCT DESIGN

(Also see Design; and PVD course under Visual Design.)

PD 400 Intermediate Product Design (Series). Preq: DF 102. May not be taken more than six times. 6(0-9) F,S. This series of courses is concerned with various social/economic age groups, various forms and rates of production, and various natural and synthetic materials. Students select from a number of vertically organized workshop studios which offer on an optional basis a wide range of program emphases.

PD (T) 471 Introduction to Textile Design I. 3(2 2) S. The first in a three-part series of courses designed to teach design technology as related to textiles, including a broad understanding of the textile industry as a total structure, technical skills development, and professional competence in the utilization of those skills for product development, design, and management.

PD (T) 472 Textile Design II/Internship. Preq: PD (T) 471. 3 Sum. Student internship in industry to gain exposure to new environments and the responsibilities of performing in a creative capacity within a corporate structure.

PD (T) 473 Textile Design III. Preq: PD (T) 471, 472. 3(2-2) F. Students develop individual textile design problem statements to be pursued as a semester project. The problems are based on specific areas as related to his or her personal development in textile design.

Selected 500-Level Courses Open To Advanced Undergraduates

PD 541, 542 Advanced Visual Design I, II. Preqs: ARC 400, LAR 400, PD 400 and PVD 400; waiver of prerequisite is at the discretion of the instructor. 6(3-9) F.S. Application of previous studies in design and visual communications to a wide variety of visual problems presented by our physical environment.

PHYSICAL EDUCATION

(All courses are taught for one-half semester unless otherwise noted. For a final grade and one semester credit to be received, the student must complete a full semester of either a full semester course, or two one-half semester courses taken in the same semester.)

PRESCRIBED COURSES

PE 100 M (F) PE 100 W (F,S) Health and Physical Fitness. (Full semester). 1(0-2). A lecture laboratory course to assess and improve the individual's physical fitness, and to convey health fitness knowledge.

PE 112 Beginning Swimming I. (8 or 16 weeks depending upon individual). 1(0-2) F,S,Sum. Teaches nonswimmers the basic swimming skills necessary to demonstrate survival swimming ability.

PE 113 Beginning Swimming II. 1(0-2) F,S. Prepares weak swimmers for the intermediate swimming course.

PE 118 Restricted Activity I. 1(0-2) F,S. Meets the needs of individuals who have temporary or permanent physical impairments. Students enrolled in this program must obtain a restrictive form from the Student Health Service.

PE 119 Restricted Activity II. 1(0-2) F,S. A follow-up of PE 118.

CONTROLLED ELECTIVE COURSES

AQUATICS

PE 221 Intermediate Swimming. 1(0-2) F,S,Sum. Gives the student competence in four basic strokes and two dives.

PE 222 Water Sports. 1(0-2) F. Water polo and water basketball, plus improvement in stamina and water skills.

PE 223 Advanced Lifesaving. Preq: PE 221 or equivalent. (Full semester). 1(0-2) F,S. Designed to qualify students for a Senior Red Cross Lifesaving certificate.

PE 224 Water Safety Instructors. Preq: PE 223 or equiv. (Full semester). 1(0-2) F,S. Designed to qualify students for a Red Cross Water Safety Instructor's rating.

PE 225 Skin Diving. 1(0-2). Designed to give students the necessary skills to enjoy safely the sport of skin diving.

PE 226 Scuba Diving. Preq: PE 225 or equivalent. (Full semester). 1(0-2) F,S. Appropriate and safe use of scuba diving equipment and related in-water skills.

PE 227 Skin Diving Leader/Assistant Instructor. Preq: PE 226. (Full semester). 1(0-2) F,S. Designed to qualify students for a skin diving leader/assistant instructor rating of scuba diving.

COMBATIVES

PE 232 Personal Defense. 1(0-2) F,S. To promote mastery of fear that may arise from the

anticipation of violent personal contact and to equip students with the techniques for personal defense. To include falls, throws, counters, locks, escapes.

PE 233 Boxing. 1(0-2) F,S. Acquaints the student with the fundamentals, skills, history and rules. Emphasis on defensive techniques.

PE 238 Wrestling. 1(0-2) F,S. Wrestling skills at the beginning level; teaching developing strength and endurance; and fostering good sportsmanship in a combative sport.

DEVELOPMENTAL ACTIVITIES

PE 117 Gymnastics. 1(0-2) F,S. Fundamentals on the parallel bars, side horse, trampoline and mats.

PE 231 Body Mechanics. 1(0-2) F,S. A program of physical development and coordinated movement.

PE 236 Track and Field. 1(0-2) F,S. Develops knowledge, skill and interest in track and field events.

PE 237 Weight Training. 1(0 2) F,S. Provides essential knowledge of the principles of muscular strength development; and, an opportunity to acquire skill in a variety of progressive resistance exercises.

PE 239 Modern Dance. 1(0 2) F,S. Knowledge, skill and application of modern dance. It emphasizes the basic fundamentals of body movement executed to music.

INDIVIDUAL SPORTS

PE 234 Square Dance. 1(0-2) F,S. Coeducational course in square dance covering mixers, clogging, Schottische, two-step, Polka, Waltz, and Mazurka. Western square dancing also included.

PE 240 Social Dance. 1(0-2) F,S. Fundamentals of leading and following including foxtrot, swing, waltz, cha cha-cha and rumba.

PE 241 Angling. 1(0-2) F,S. Spin, fly and bait casting and an understanding of game fishing.

PE 242 Badminton. 1(0 2) F,S,Sum. Skill development in the fundamental skills and strategy of the sport are emphasized. Includes history and rules of competition.

PE 243 Bowling. 1(0-2) F,S, Sum. Ball selection, grips, stance and delivery along with rules, history, scoring and the general theory of spare coverage. Additional fee assessed.

PE 244 Fencing. 1(0-2) F,S. Fundamentals, skills, techniques and rules.

PE 245 Golf. 1(0-2) F,S,Sum. Teaches beginners the grip, stance, swing and use of the various clubs, along with the history of sport and etiquette of play.

PE 246 Handball. 1(0-2) F,S. Fundamental skills, history and rules.

PE 247 Roller Skating. 1(0-2) F,S. The fundamental skills of skating, emphasizing balance and speed.

PE 248 Squash. 1(0-2) F,S. Fundamental skills, history and rules.

PE 249 Tennis I. 1(0-2) F,S,Sum. Gives beginners a knowledge of history, rules and strategy as well as fundamental skills of tennis.

PE 250 Tennis II. Preq: PE 249 or equivalent. 1(0-2) F,S. A follow-up of PE 249 with emphasis on game strategy and doubles play.

PE 251 Target Archery. 1(0 2) F,S,Sum. Emphasizes development of fundamental skills; including safety, competition, and selection and care of equipment.

PE 252 Downhill Skiing. 1(0-2) F,S. Fundamentals including safety, care of equipment, control, straight run, turns, and slalom. Offered in December during holidays and spring semester break dependent upon weather conditions. Minimum of 3 days on slopes required for credit. Additional fee assessed.

PE 253 Orienteering. 1(0-2) F,S. To teach the skills used in the sport of orienteering.

Orienteering is the ability to navigate on foot from defined point to defined point, with use of map and compass, in the shortest possible time.

PE 254 Beginning Equitation. (Full Semester) 1(0-2) F,S. Beginning course emphasizing hunt seat equitation, care of horse and tack and control skills at the walk, trot and canter. (Offered in conjunction with MacNair's Stables under supervision of Department of Physical Education). Additional fee assessed.

PE 256 Racquetball. 1(0-2) F,S. Emphasis on skills development and competition. Includes equipment selection, history and rules.

PE 257 Backpacking Skills. 1(0 2) F,S. Instruction and direct experience in backpacking skills. Includes required weekend field trip. Emphasizes individual safety, environmental conservation techniques, and proper equipment selection.

PE 258 Basic Rockclimbing. 1(0 2) F,S. Instruction and direct experience for the beginning rock climber. Includes required field trip. Emphasis is on safe rope systems for belaying and basic movement on rock.

TEAM SPORTS

PE 116 Soccer. 1(0-2) F,S. Emphasizes the basic skills of soccer. Team offense and defense are taught. Includes competitive experience in class.

PE 260 Lacrosse. 1(0 2) F,S. Designed to teach the history, rules, strategy and fundamental skills of Lacrosse.

PE 261 Basketball (Men). 1(0-2) F,S. Emphasizes offensive and defensive skills development and systems of team work. Includes coverage of history and rules of the sport.

PE 262 Basketball (Women). 1(0 2) F,S. Emphasizes offensive and defensive skills development and systems of team work. Includes coverage of history and rules of sport.

PE 265 Softball. 1(0 2) F,S,Sum. Fundamental skills, history and rules.

PE 267 Touch Football. 1(0-2) F. Skills, history, rules and strategy of touch football.

PE 268 Touch Football (Women). 1(02) F. Skills, history, rules and strategy of touch football.

PE 269 Volleyball. 1(0-2) F,S,Sum. Skills, history, rules and strategy.

VARSITY SPORTS

PE 271 Varsity Sports I. 1(0-2) F,S. For students transferring to a varsity sport for a term (eight weeks) for the first time.

PE 272 Varsity Sports II. 1(0-2) F,S. For students making their second transfer to a varsity sport.

PE 273 Varsity Sports III. 1(0 2) F,S. For students making their third transfer to a varsity sport.

PE 274 Varsity Sports IV. 1(0-2) F,S. For students making their fourth transfer to a varsity sport.

HEALTH EDUCATION

PE 280 Emergency Medical Care and First Aid. (Full semester). 2(2-0) F,S,Sum. This course does not constitute credit toward meeting physical education requirements. Knowledge and techniques for rendering prompt and appropriate first aid and/or emergency medical care in situations when the services of qualified medical personnel are unavailable or delayed.

PE 285 Personal Health. (Full semester). 2(2-0) F,S. This course does not constitute credit toward meeting physical education requirements. A lecture-discussion course with emphasis on personal health including mental health, alcoholism, drugs, sexuality, nutrition, family health, diseases, health quackery and health practitioners.

PHILOSOPHY

(Also see Religion.)

PHI 201 Logic. 3(3-0) F,S,Sum. An introduction to the methods of deductive inference. The concepts of validity and implication are defined and applied to statements and arguments. Staff

PHI 205 Problems and Types of Philosophy. 3(3-0) F,S,Sum. In this introductory course the matters discussed will always be those with a history of importance in philosophy, such as problems concerning God, freedom, justice, and the nature and objects of human knowledge. Staff

PHI 206 Problems and Types of Philosophy II. Preq: PHI 205. Course is open only to students participating in the Transition Program. 3(3-0) S. An extension of the introduction to philosophy provided by PHI 205, examining philosophical issues reflected in historical events and social conflicts in the United States from 1914 to the present. Sparer

PHI 250 Practical Reasoning. 3(3-0) F,Sum. An introduction to nonformal reasoning; in particular, to induction and rational decision-making under conditions of uncertainty. Topics to be included are the analysis of causal connections, the nature of probability, the role of definition in language, and the examination of commonly committed fallacies. Metzger

PHI 298 Special Topics in Philosophy. 3(3-0) F,S. 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. Staff

PHI 300 Early Western Philosophy. 3(3-0) F. The philosophical movements of Western Civilization from the pre-Socratics of ancient Greece to the scientific revolution of the 17th century, with particular emphasis on Plato and Aristotle. Bredenberg

PHI 301 Modern Western Philosophy. 3(3-0) S. A critical survey of selected works of the major Western philosophers from the 17th century to the present. Metzger

PHI (ED) 304 Philosophy of Education. 3(3-0) F,S,Sum. An examination of the fundamental philosophical questions concerning education—namely, What should we teach people, how should we teach it, and why? The course is further concerned with analyzing the very concepts of teaching and learning. Bryan

PHI 305 Philosophy of Religion. 3(3 0) F,S. An examination of the questions of the existence of God and of the language about God, including such traditional problems as verification, meaning, evil, immortality, and creation. Stalnaker

PHI 306 Philosophy of Art. 3(3-0) F,S,Sum. An 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. Bredenberg

PHI 307 Morality and Human Happiness. 3(3-0) F,Sum. An exploration of the relationship between morality and happiness—one's own and that of others. The course investigates both the nature of human happiness and the nature of justification of moral rights and obligations. Regan

PHI 308 Contemporary Moral Philosophy. 3(3-0) S. An exploration of contemporary philosophical treatment of such questions as What is the meaning of ethical terms like "good," "bad," "right," and "wrong?" and How can moral judgments be justified or shown to be valid? Regan

PHI 309 Contemporary Political Philosophy. 3(3-0) F,S. An examination of current discussions of basic concepts in political philosophy, such as liberty, equality, justice, natural rights, and democracy, with the aim of clarifying and resolving disputes concerning the relation of the individual to the state. VanDeVeer

PHI 310 Existentialism. 3(3 0) F,S. Discussion of the central existentialist motifs in the work of Kierkegaard, Nietzsche, Heidegger, Sartre, and others, and their influence upon contemporary culture. Fitzgerald

PHI 311 Philosophical Issues in Medical Ethics. 3(3-0) F. Discussion of 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. The course considers individual rights and fairness and emphasizes conceptual clarity and the assessment of moral principles. VanDeVeer

PHI 312 Philosophy of Law. 3(3-0) S. An examination of the fundamental concepts of legal theory. Topics for discussion include the characterization of a legal system, the justification of punishment, theories of responsibility, liability, and legal cause. The general views examined will be tested by application to concrete issues that are the subject of litigation in the Federal courts. Sparer

PHI 319 Roots of Contemporary Philosophy. 3(3-0) F. A critical examination of the most recent history of contemporary Anglo-American philosophy. Following a brief presentation of Nineteenth Century idealism, the course traces in detail the rise and development of realism in the current century. The foci of the course are the historical roots of modern scientific realism, beginning with the naive realism of Moore and Russell and passing successively to Logical Positivism, Ordinary Language philosophy, and Quinean empiricism. Auerbach, Nagel

PHI 330 Metaphysics. 3(3 0) S. An examination of metaphysical problems and questions, most of which have classical origins but which will usually be treated from a contemporary perspective. Typical problems are those connected with appearance and reality, free-will and determinism, mind and body, and space and time. Carter

PHI 333 Theory of Knowledge. 3(3 0) F,S. Analysis of such central concepts as knowledge, belief, and truth, and the investigation of the principles by which claims to know may be justified. Carter

PHI 335 Symbolic Logic. 3(3-0) F,S. An introduction to modern symbolic logic. Examination of the procedures for the translation of certain English sentences into logical notation and for the manipulation of that notation, so as to produce correct inferences in it. Also an introduction to the mathematical study of logic, i.e., of the properties of the symbolic system itself. Auerbach, Levin

PHI 336 Topics in the Philosophy of Logic and Language. 3(3-0) F,S. Each year this course will treat one or more of the problems associated with the philosophical investigation of logic and language. Among the many topics covered will be the distinction between sentences, statements, and propositions; referential opacity; the modalities; the nature of grammar; problems in semantics; and the relation between formal and natural language. Staff

PHI 340 Philosophy of Science. 3(3-0) F,S. An examination of the character and function of "explanation" in scientific activity, the concepts of law and theory, the role of inductive confirmation, and the relationship between natural and social sciences. Nagel

PHI 341 Topics in the Philosophy of Science. 3(3-0) S. This course provides an opportunity for the detailed investigation of some of the special problems in contemporary philosophy of science. Each year the course will consider at least some of the following problems: explanation and theory, confirmation, philosophy of physics, philosophy of psychology, and the philosophy of the social sciences. Auerbach, Nagel

PHI 402 Advanced Logic. Preq: PHI 335 or CI. 3(3-0) S. A formal study of the notions of truth and provability, this course emphasizes some of the theorems of mathematical logic having philosophical importance: Gödel's incompleteness results and Church's theorem, for example. An introduction to recursive function theory. Levin

PHI 492 Philosophy Seminars on the Human Condition. 3(3-0) F,S. The seminars will be directed to exploring in a philosophical way the wide range of issues characterizing human experience and the human condition—such issues as capital punishment, abortion, civil rights, automation, and the quality of existence. Staff

PHI 498 Special Topics in Philosophy. Preq: Six credits in PHI. 1-6 F,S. This course is used to offer areas of study that appear only rarely in the curriculum. It will also function as a readings course for honors students in philosophy. Staff

PHYSIOLOGY

Selected 500-Level Courses Open To Advanced Undergraduates

PHY (ANS) 502 Reproductive Physiology of Vertebrates. 3(3-0) S. (See animal science.)

PHY 503 General Physiology I. Preq: Sr. or grad. standing. 3(3 0) F. The general principles of homeostatis will be discussed, emphasizing the importance of integrative action. The following systems will be studied: respiratory, cardiovascular, renal, reproductive, and myological. Staff

PHY 504 General Physiology II. Preq: Sr. or grad. standing. 3(3-0) S. The general principles of homeostatis will be discussed, emphasizing the importance of integrative action. The following will be studied: alimentary, reticuloendothelial, central nervous, autonomic nervous, and endocrine systems; detoxication mechanisms; special senses; and the response of man to the environment. Staff

PHY (ZO) 513 Comparative Physiology. 4(3-3) S. (See zoology.)

PHY (MB, PO, VET) 513 552 Immunobiology. 3(3 0) S. (See poultry science.)

PHY (BCH) 553 Physiological Biochemistry. 3(3-0) S. (See biochemistry.)

PHY (ZO, ENT) 575 Physiology of Invertebrates. Preq: ZO 202 or CI. 3(3-0) S. The course deals with the physiology of the invertebrates, including the Insecta but excluding the Protozoa. The unity of the physiology of the various groups is stressed, and the relationship of physiology to contemporary biology and to other related biological fields will be illustrated. Staff

PHY (ANS) 580 Mammalian Endocrine Physiology. 3(3 0) F. (See animal science.)

PEST MANAGEMENT

PM 111 Introduction to Integrated Pest Management. Preq: BS 100. 1(1-0) S. An introductory course which acquaints pest management majors as well as students from other curricula with the basic principles and purposes of integrated pest management. The subject is developed from both historical and contemporary perspectives. The relationship of pest management to such problems as environmental pollution, pesticides, the energy and food-population crises, land-use planning and stable crop production is emphasized. Haning

PM 415 Principles of Pest Management. Preqs: BO (ZO) 360, PP 315, ENT 312. Coreq: CS 414. 4(3-3) F. This interdisciplinary course integrates knowledge and understanding needed for making sound pest management decisions. Topics include in-depth discussion of the concepts and methods of integrated control. Systems of crop and pest management, including examples of existing pest management programs that integrate chemical, biological, and cultural control practices are presented. The laboratory includes field trips, and exercises in economic analysis and modeling. Haning

PM 490 Pest Management Seminar. Preq: PM 415 or its equivalent. 1(1-0) S. Written and oral presentation of scientific information relating to current trends in theoretical and applied pest management practices. Haning

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 351 Grading and Evaluation of Poultry Products. Preq: PO 301. 2(1-3) F. Experience in grading and evaluating poultry products, such as dressed broilers, fowl, turkeys, shell eggs and broken out eggs. Parkhurst

- PO (VET) 401 Poultry Diseases.** 4(3-3) S. (See veterinary science.)
- PO (FS) 404 Poultry Products.** Preq: CH 220 or 221. 3(2-3) F. (See food science.)
- 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.
- PO 410 Production and Management of Game Birds in Confinement.** Preq: PO 201. 3(2-3) S. Principles of management associated with the successful propagation and rearing of game birds, ornamental birds and waterfowl in confinement. Included will be information related to permit requirements at the state and federal level as well as shooting preserve regulations. Housing and pen requirements, nutrition and disease control will also be stressed. Parkhurst
- PO (ANS, NTR) 415 Comparative Nutrition.** Preq: CH 220 or 221. 3(3-0) F. Fundamentals of animal nutrition, including the classification of nutrients, the requirement and general metabolism by different species for health, maintenance, growth and other productive functions. Donaldson or Ramsey
- PO 420 Turkey Production.** 2(1-2) S. Principles and current practices of turkey production. Staff
- PO 421 Commercial Egg Production.** 2(1-2) S. Principles and current practices of commercial egg production. Carter
- PO 422 Incubation and Hatchery Management.** 2(1-2) F. Principles and current practices of incubation and hatchery management. Staff
- PO 423 Broiler Production.** 2(1-2) F. Principles and current practices of broiler production. Parkhurst
- PO 490 Poultry Seminar.** Preq: Senior standing. 1(1-0) S. Topics related to current and possible future problems in poultry science and the poultry industry are assigned for oral report and discussion. Qualified guest lecturers are invited to present and discuss problem areas encountered in their responsibilities to the industry. Cook
- PO 495 Special Problems in Poultry Science.** Preq: Jr. standing and CI. 1-6 F.S. Individualized study of problems in student's interest area and not covered in scheduled courses. Emphasis on research problems developed with faculty approval. Staff
- Selected 500-Level Courses Open To Advanced Undergraduates*
- PO (GN) 520 Poultry Breeding.** Preq: GN 411. 3(2-2) S. Application of genetic principles to poultry breeding, considering physical traits and physiological characteristics. Krueger
- PO (ZO) 524 Comparative Endocrinology.** Preq: ZO 421 or equivalent. 4(3-3) S. Study of the endocrine system with respect to its physiological importance to metabolism, growth and reproduction. Staff
- PO (MB, PHY, VET) 552 Immunobiology.** Preq: MB 551. 3(2-3) S. A basic study of the ontogeny of immunobiological tissues and their subsequent roles in immunity. Primary emphasis will be on cell-mediated (T-cell) immunity and immunogenetics. Specific topics include blood groups, histocompatibility antigens, organ transplantation, immunosuppression and tolerance. Some inter-relationships of other physiological systems with the immune system will be discussed. Morgan

PLANT PATHOLOGY

- PP 310 Diseases of Fruit Crops.** Preq: BS 100. Coreq: PP 315. Previous or concurrent enrollment in PP 315. 1(0-3) F 1979, Alt. yrs. Representative diseases and associated pathogens (nematodes, bacteria, viruses, fungi) of fruit crops will be studied. Emphasis will be placed on diagnosis, biology of the pathogen and available control techniques for these diseases. Sutton
- PP 311 Diseases of Vegetable Crops.** Preq: BS 100. Coreq: PP 315. Previous or concurrent enrollment in PP 315. 1(0-3) S 1980, Alt. yrs. Representative diseases and associated

pathogens (nematodes, bacteria, viruses, fungi) of vegetable crops will be studied. Emphasis will be placed on diagnosis, biology of the pathogen, and available control techniques for these diseases.
Averre, Jenkins

PP 312 Diseases of Woody Ornamentals and Turf Grasses. Preq: BS 100. Coreq: PP 315. Previous or concurrent enrollment in PP 315. 1(0-3) F,S. A study of the major diseases of woody ornamentals and turf grasses caused by plant pathogenic nematodes, viruses, bacteria, and fungi. Emphasis will be placed on diagnosis, biology of the pathogen and available control techniques for these diseases.
Benson, Lucas

PP 313 Diseases of Herbaceous Ornamentals. Preq: BS 100. Coreq: PP 315. Previous or concurrent enrollment in PP 315. 1(0-3) F. Representative diseases and associated pathogens (nematodes, bacteria, viruses and fungi) of herbaceous ornamentals will be studied. Emphasis will be placed on diagnosis, biology of the pathogen and control techniques.
Strider

PP 314 Diseases of Field Crops. Preq: BS 100. Coreq: PP 315. Previous or concurrent enrollment in PP 315. 1(0-3) F,S. Representative diseases and associated pathogens (nematodes, bacteria, viruses, fungi) of field crops will be studied. Emphasis will be placed on diagnosis, biology of the pathogen and available control techniques for these diseases.
Powell

PP 315 Plant Diseases. Preq: BS 100. Coreq: PP 310, 311, 312, 313, or 314 or equivalent. One or more lab courses of PP 310-PP 314 series must be taken concurrently with PP 315. 3(3-0) F,S. The symptoms, nature and control of plant diseases caused by fungi, bacteria, virus and nematodes are studied, along with those due to abiotic factors and parasitic seed plants. Important phytopathological concepts and methodology are developed, based on thorough knowledge of representative major types of plant diseases.
Powell

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: 1) principles of plant pathology; 2) symptomatology and diagnosis; 3) nature of disease-causing agents; 4) physiology, ecology and dissemination of disease-causing agents; 5) mechanisms of pathogenesis; 6) epidemiology and environmental influences; 7) principles of control.
Grand

PP 450 Nematode Diseases of Plants and Their Control. Preq: PP 315 or 318. 2(1-3) F. This course will consider important plant diseases caused by pathogenic nematodes. Laboratory methodology, as well as diagnostic techniques will be studied, including assay of soil and plant tissues for nematodes. Morphology and anatomy of important pathogenic genera will be compared with non-pathogenic soil forms. Kinds and population densities will be considered in relation to symptoms and plant damage. General biology, including life cycles, host-parasite relationships, environmental influences, and principles and practices of control will be considered.
Sasser, A. Triantaphyllou

Selected 500-Level Courses Open To Advanced Undergraduates

PP 500 Plant Disease Control. Preq: PP 315. 3(2-3) S. Disease control strategies and tactics are developed in a practical manner. Control economics and practices are considered in relation to principles and current research on biological, cultural, physical and chemical methods. Disease resistance and regulatory methods are also discussed.
Jenkins

PP 501 Phytopathology I. Preq: PP 315 or equivalent. 4(2-6) F. Basic concepts of plant diseases caused by fungi and bacteria and their control will be studied. The history, classification, terminology, etiology, effect of environment on disease and variability in pathogens will be considered. Laboratory sessions will illustrate the topics mentioned above as they relate to diseases caused by fungi and bacteria.
Echandi

PP 502 Phytopathology II. Preq: PP 315 or equivalent. 5(3-6) S. A study of virus, nematode, and abiotic diseases of plants with an overall consideration of major topics such as epidemiology, and control. Laboratory sessions include basic studies of viruses, nematodes and epidemiology and useful research and diagnostic techniques.
Beute, Main, Barker, Schmitt, Moyer

PP 503 Identification of Plant Pathogenic Fungi. Preq: Mycology or one advanced course in PP. 3(4-12) Sum. A study of the recognition and identification of fungi which cause plant diseases and the differentiation of fungal diseases from those caused by other agents. Special consideration is given to use of keys in the identification of fungi and the major sources of descriptive information on plant pathogens. (Offered 2nd summer session 1980 and alt. years.) Grand

PP 505 Histopathology. Preq: PP 501 or equivalent. 2(1-3) F. Anatomical changes that occur in diseased plant tissues will be studied. The appropriate procedures of microtechnique necessary for interpretation of pathological changes in plant tissues will be considered. Laboratory assignments will involve projects on specific diseases including photography and scientific writing. Milholland

PP (MB, BO) 575 The Fungi. 3(3-0) F. (See botany.)

PP (MB, BO) 576 The Fungi Lab. 1(0-3) F. (See botany.)

PP 595 Special Problems in Plant Pathology. Preq: CI. Credits Arranged, Maximum 6. Investigation of special problems in plant pathology not related to a thesis problem. The investigations may consist of original research and/or literature survey. Graduate Staff

POLITICAL SCIENCE

PS 201 The American Governmental System. 3(3-0) F.S. A study of the American federal system, integrating national and state government, 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. Staff

PS 206 Local Governmental Systems. 3(3-0) F.S. In addition to examination of traditional local forms city, county, township, and district attention to the national, state, and regional contexts for local government. Topics include federalism and intergovernmental relations, governmental structures, political processes and political power, urbanization and problems of social and technological change, and approaches to reform. Block, Clary, McClain, Rassel

PS 210 Introduction to Public Policy. 3(3-0) F. Introduction to public policy formulation and analysis, including agenda-setting strategies, problems of legitimation, the appropriations process, implementation, evaluation, resolution, and termination. Garson

PS 231 International Relations. 3(3-0) F. The patterns of international life, the controls upon international behavior, including the development of the United Nations and the major problems in international relations since World War II. Attention to the national interests and foreign policies of the states belonging to the Western and Soviet blocs, with emphasis on the positions of the United States and the Soviet Union, and to the development and impact of newly emerging nations. Petersen

PS 236 Introduction to Global Politics. 3(3-0) F.S. Man's political activities viewed from a dynamic and future-oriented, global (planetary) perspective. The structure of the global political system in terms of the principal actors, including nation-states, international organizations, multi-national corporations, and subnational actors. Attention to problems having planetary dimensions, such as wars and arms races; poverty, inequality, and injustice; and the ecological concerns of population growth, resource depletion, and pollution. Soros

PS 271 Introduction to Political Science. 3(3-0) F.S. A survey of existing knowledge about politics and political systems, including the theories and characteristics of political behavior and political institutions within and among nation-states. Kebschull, Petersen

PS 298 Special Topics in Political Science. 3(3-0) F.S. Utilized for guided research or experimental classes at the sophomore level. Staff

PS 303 Black Americans in American Politics. Preq: Six hours of social science. 3(3-0) F.S. The political activity of the Afro-American; the sources of and the kinds of attitudes he brings into the American political system; the contrast in political activity engaged in by different black groups and reasons for the differences; the impact of the blacks' efforts on

policy-making institutions such as city councils, legislatures and executive branches of government at the state and national level.

Staff

PS 306 The Legal Subsystem: Law and Courts in the American Political System. 3(3-0) F.S. The role of courts, state and federal, in the political system, including: 1) structure, court organization and legal personnel, 2) law and the need for social order, including the role of protest and civil disobedience, and 3) functions performed by courts in the political system, from dispute settling to the initiation of social change.

Rubin

PS 307 Introduction to Criminal Law in the United States. 3(2-2) F.S. A broad survey of the general principles underlying the criminal law in the United States. Attention is paid to the classification of crimes, the criminal act, factors affecting criminal responsibility, and various types of offenses. Includes observation of state and federal court sessions as appropriate.

Staff

PS 308 Supreme Court and Public Policy. 3(3-0) F.S. The role of the Supreme Court in American politics, with particular emphasis on the way groups use litigation as a form of political activity. Readings include relevant court cases as well as descriptions of the Supreme Court in action.

Rosch, Rubin

PS 311 Criminal Justice Policy Process. 3(3-0) F.S. The processes of formulating and implementing policies in various criminal justice institutions. Police agencies, solicitors' offices, courts, prisons, and probation and parole departments are analyzed as public bureaucracies. Emphasis on how key executives—police chiefs, judges, and prison wardens interact with subordinates and with the larger political environment outside their organization. Students consider policy alternatives and obstacles administrators encounter in trying to get compliance with policy directives.

Fairchild

PS 312 Introduction to Public Administration. Credit for PS 312 and PS 511 is not allowed. 3(3-0) F.S. An introductory survey of the role of public administration in modern society. Emphasis is placed on the study of the effectiveness and responsiveness of bureaucracies. Case study analysis is among the techniques used to examine such topics as the politics of city, state, and federal bureaucracy; people in bureaucracies; bureaucracy in policy areas; ethics and responsibilities.

Swiss

PS 313 Women and Public Policy. 3(3-0) F.S. The course examines the role of women as participants in a policy-making system, the processing of feminist demands within that system, the impact of public policy from a feminist perspective, and emerging issues in the women's rights movement.

Stewart

PS 331 U. S. Foreign Policy. 3(3-0) F.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 policymaking process.

Gilbert

PS 332 Soviet and Soviet Bloc Foreign Policy. Preg; Jr. standing. 3(3-0) F.S. The elements of continuity and change in Soviet foreign policy from 1917 to the present and the post World War II policies of the Eastern European states. Foreign policy decisions are examined in light of the national interests of the Soviet Union and the Eastern European states. Attention to the emergence of polycentrism, the Sino-Soviet split, and Soviet bloc relations with the West.

Mastro

PS 336 Global Environmental Politics. 3(3-0) F.S. A global perspective of the political dimensions of man's relationship to the natural environment. Attention will be given to emerging international political problems related to population growth, food supply, energy and mineral resources, and environmental pollution. Proposals for coping with these problems on an international or global basis will be investigated.

Soroos

PS 341 Contemporary Western European Political Systems. 3(3-0) F. Focuses upon the contemporary political systems of Great Britain, France, and the Federal Republic of Germany. The political cultures, institutions, and processes of each will be analyzed to distinguish the similarities and differences of these three democracies. Brief attention will be given to some of their major social and economic policies and to the movements to integrate these states as part of the effort to integrate the states of Western Europe.

Kebschull

- PS 342 Political Systems of China and Japan.** 3(3-0) S. A comparative analysis of the structure and processes of politics in China and Japan. Petersen
- PS 343 Southeast Asia: Politics and Political Change.** 3(3-0) S. The political systems and the processes of political change in 10 states of Southeast Asia from Burma on the west to the Philippines on the east. Some attention to individual case studies of political systems, but primarily presented in a comparative manner dealing with particular challenges and responses common to several systems. Tilman
- PS 344 Soviet Politics.** 3(3-0) F.S. The contemporary Soviet political system, its structure, functions and processes, with brief consideration of the historical and ideological base of Soviet politics. Analysis designed to elucidate the similarities and differences of the Soviet system with other political systems. The Soviet system will be tested against a theoretical model of totalitarian dictatorships. Mastro
- PS 345 Governments and Politics in the Middle East.** 3(3-0) S. An overview of the historical, socio-cultural, economic and ideological characteristics of the Middle East, and of various countries within the region, for the purpose of considering in detail the processes and problems of political modernization and the nature of conflicts, particularly the Arab-Israeli conflict. Staff
- PS 346 Political Systems of New States.** 3(3-0) F. General characteristics of the political systems of the new states in Asia and Africa. Survey of the pattern and nature of colonialism, the independence movements, and the contemporary social and economic conditions of the new states. Focus on political ideologies, elites, and organizations and processes. Attention to the role of intellectuals and the military. An examination of major political, social, and economic problems. Kebschull
- PS 361 Introduction to Political Theory.** 3(3-0) F.S. The course will examine the basic questions of the nature and purpose of politics and the principles of political right as treated by such writers as Plato, Aristotle, Machiavelli, Locke, Mill, Rousseau, Marx, and Nietzsche. Attention will be given to their treatments of the criteria of civil justice, the relationship between human nature and politics, and the character of political wisdom. Emphasis will be placed on careful reading of primary texts. Kessler
- PS 371 Methodology of Political Science.** Preq: PS 201 or 271 or CI. 3(3-0) F.S. An analysis of the principles and procedures of political science research including: 1) the philosophy of science; 2) theory construction; 3) sampling, measurement of political variables and research designs; and 4) other methods of political research, such as content analysis, use of aggregate data and simulation research. Soroso
- PS 401 American Parties and Pressure Groups.** 3(3-0) F. Political parties and interest groups as instruments for shaping public policy and implementing democratic values. They are considered as variables in the larger American system within which they exist. Attention on the nature of organization, membership and leadership recruitment process, and problems in aggregating votes. Topics such as political style—the relationship between major and minor parties and the differences between the major parties. Holtzman
- PS 402 Campaigns and Elections in the American Political System.** Preq: PS 201. 3(3-0) F.S. Deals with the nature and functions of campaigns and elections in the American political system. Among the topics to be explored are American electoral behavior, techniques of political campaigning, recent reforms in campaign financing, the role of political parties in campaigns and elections, the classification of elections, with particular concern directed to the concepts of "issue voting" and "realignment." Staff
- PS 406 Politics and Policies of American State Governments.** 3(3-0) F.S. A comparative study of the politics and policies of the 50 states. Cultural, socio-economics and political variations and state response to intergovernmental domestic programs. The analysis of state efforts in taxation, education, health, welfare, transportation and regulatory policies, the implementation and administration of national programs in the state and the state's role in urban affairs. Williams
- PS 408 Urban Politics in a Changing South.** Preq: Jr. standing. 3(3-0) F.S. A study of urban and urban-related problems through theories from politics, sociology, and economics, and their application to an existing environment. Formal study and research in various local

communities. Students will be involved with public and private agencies and with local leaders in ongoing programs in Raleigh and adjacent communities. Staff

PS 411 Public Opinion in Democracies. Preq: Three hours PS. 3(3-0) F.S. The nature of public opinion and its functions in a democratic system of government. Focus is primarily on public opinion in the United States but also comparisons with other nations. Areas emphasized are: theories concerning opinion formation and functions, public opinion research methodology, public opinion and policy development, and empirical studies on public opinion. Staff

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 Criminal Justice. Preq: PS 311. 3(3-0) F. A study of politics and administration in the American criminal justice system. The interrelationships between ideology, organization, and policy outputs are emphasized in the analysis of major problems confronting the system today. Topics included are: intergovernmental relations, discretionary justice, impact of judicial decisions on criminal justice administration, and management trends in criminal justice bureaucracies. Fairchild, Rosch

PS 431 International Organization. 3(3-0) S. The evolving machinery and techniques of international organization emphasizing the establishment, operation and development of the United Nations. Petersen

PS 436 Politics of War and Peace. 3(3-0) F. Alternative conceptions of conflict, violence, and peace; the problems of wars and of arms races; approaches to arms control and disarmament; strategies of conflict management and reduction; theories of development; and designs of alternative future world orders. Soroos

PS 437 National Security Policy. Preq: PS 331. 3(3-0) S. An investigation into 1) the making of security policy, including the role of the Executive, Congress, and non-governmental actors; 2) the evolution of changing assumptions, strategies, and goals; and 3) the nature of U.S. security requirements, U.S. military commitments abroad, and the "costs" of strategies based on arms superiority, arms control and disarmament. Gilbert

PS 445 Comparative Systems of Law and Justice. Preq: PS 311. 3(3-0) S. An introduction to the study of legal culture and administration of justice in Western European and Communist political systems, with a view to comparison with the American system of law and justice. The impact of legal ideology on such topics as political justice, police administration, corrections, and judicial processes is emphasized. Fairchild, Rosch

PS 446 Comparative Communist Systems. Preq: PS 344 or 332. 3(3-0) S. A study of the international Communist movement and the evolution of the international sub-system of Communist states. Focuses on the Soviet and Chinese systems as alternative models for development in Communist and non Communist states. Additional emphasis is placed on the institutional, political and ideological similarities and differences within the Communist world and major Communist parties outside the Communist state system. Mastro

PS 447 Political Development. Preq: Six hours of political science. 3(3-0) F.S. Alt. yrs. Examines the concept, theories, characteristics and problems of political development. Information derived from comparative cultural and political studies is employed in an attempt to discover patterns of change related to political development. Individual states and areas of the world are examined to evaluate the successes and failures in achieving political development. Kebschull

PS 448 Politics of European Integration. Preq: Six hours comparative politics. 3(3-0) S. Focuses on the political forces, institutions, and processes affecting the movement toward European integration. Primary consideration is given to the politics of the European community, composed of the European Economic Community (the Common Market), the European Coal and Steel Community, and the European Atomic Energy Community. The supranational characteristics of the Community's institutions and laws are compared with those of the member states. Individual research papers are required. Kebschull

PS 490 Readings and Research in Political Science. Preq: Consent of department. 1-6 F.S. To enable undergraduate students to pursue a subject of particular interest to them by

doing extensive readings or research in that subject under direct, individual faculty supervision.
Staff

PS 491 Internship in Political Science. Preq: CL 1-6 F,S,Sum. Internship in a governmental agency, interest group, or like organization involves seminar or formal report.
Garson, Staff

PS 492 Honors Readings and Thesis. Preq: Admission to Honors Program and CL. Enrollment limited to Political Science honors majors. 3-6 F,S,Sum. Independent reading and preparation of an honors thesis. Topic and mode of study to be determined by the student and a supervising faculty member.
Staff

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.
Staff

Selected 500-Level Courses Open To Advanced Undergraduates

PS 502 The Legislative Process. Preq: PS 206 or CL 3(3-0) S. A study of the formulation of public policy from the institutional and behavioral viewpoints. Important current legislative problems at the congressional and state legislative levels will be selected and will serve as a basis for analyzing the legislative process.
Holtzman

PS 506 American Constitutional Theory. Preq: PS 271 or CL 3(3-0) F. Basic constitutional doctrines, including fundamental law, judicial review, individual rights and political privileges, and national and state power. Special attention is given to the application of these doctrines to the regulation of business, agriculture and labor and to the rights safeguarded by the First, Fifth and Fourteenth Amendments to the Constitution.
Cahill

PS 507 Constitutional Theory II. Preq: Advanced undergrad. or grad. standing. 3(3-0) F,S. A continuation of PS 506, but may be elected separately. An examination of leading constitutional cases, especially in the fields of civil liberties and individual rights, and the writings of leading commentators.
Cahill

PS 508 Urban Politics. Preq: PS 206. 3(3-0) F,S. A comparative study of political conditions in cities and localities. Topics will include the formal structures and rules of city and metropolitan governments, and the relationships to the informal norms and distribution of power; patterns of local decision-making; elite recruitment and citizen participation; variations of local autonomy and the scope of local politics; and approaches to urban policy issues.
Graduate Staff

PS 509 Problems in Urban and Metropolitan Area Government. Preq: PS 206 or CL 3(3-0) S. This course examines theory and research on problems affecting governments in metropolitan areas. Principle attention is given to those problems which affect (or result from) governmental structure, institutions, and politics and to the alternative approaches to their solution.
Graduate Staff

PS 511 Public Administration. Preq: PS 271 or CL 3(3-0) F,S,Sum. A study of the factors which contribute to goal displacement in public agencies and the institutions, concepts and techniques which may be used in such agencies to reduce the effects of these factors.
Block, McClain, Rassel, Stewart, Swiss

PS 512 Comparative Administration. Preq: PS 511 or 346 or CL 3(3 0) F,S. Concentration will be on administrative systems of developing nations with limited attention to developed systems. The major emphasis will be on administrative aspects of governmental change and modernization in developing nations; colonial influence on administration; problems of establishing new nations and adapting to change in established states; bureaucratic development and behavior; theories of development administration.
Graduate Staff

PS 514 Public Finance. Preq: EB 205. 3(3-0) F. A survey of the theories and practices of governmental taxing, spending, and borrowing, including intergovernmental relationships and administrative practices and problems.
McClain

PS 516 Public Policy Analysis. Preqs: Grad. standing; advanced undergrad. standing and CL 3(3-0) F,S,Sum. Course will focus on the theories and methodology of analyzing and explaining public policy and the substance of recent domestic policies in the human and

physical resources area, including welfare, poverty, education, housing, urban renewal, transportation, recreation-conservation, and agriculture. Williams

PS (SOC) 517 The Police Bureaucracy in a Democratic Society. Preq: Sr. or grad. standing. 3(3-0) S. This is a political science seminar which focuses on the proposition that police departments are bureaucratic organizations which can be studied as such. Emphasis is placed on understanding the process by which police policy is made. Internal and external, psychological and structural variables are identified in tracing decisions on specific issues. Thus, attitudes of policemen, the nature of their work, and the resources and power of various constituencies are factors seen as determining police behavior. Graduate Staff

PS 561 Political Thought: Plato to the Reformation. Preq: Cl. 3(3-0) F. The emergence and development of the theories underlying or explaining the political aspects of behavior, approached through the study of the writings of the principal political philosophers from the days of the Greek city-state to the Reformation. Kessler

PS 562 Modern Political Theory. Preq: Cl. 3(3-0) S. A study of the state and its relationship to individuals and groups, approached through reading of selected passages from the works of outstanding philosophers from the 16th century to the present. Kessler

PS 563 Power and Ideology. Preq: Advanced undergrad. or grad. standing. 3(3-0) F. This course will explore competing theories of power and its distribution in the United States, and of the nature of ideology. It will analyze various forms of elite theory, particularly pluralist theory and its critics and of empirical democratic theory, with specific reference to the concepts of power and ideology. Primary attention will be given to the case of the United States, with projections made regarding the nature of power and ideology, and the prospects for democracy, in post-industrial societies. Staff

PS 565 American Political Thought. Preq: Sr. or grad. standing. 3(3-0) F,S,Sum. The course will examine and evaluate major American writings on the nature and purpose of politics. Readings will be grouped under the following topics: (1) various interpretations of the American Constitution and the principles embodied therein; (2) writings on civil and natural rights; (3) the character of American liberalism; (4) Black American political thought and (5) the contemporary crisis in liberal thought. The purpose is to develop the independent capacity to read and reflect with care on the grounds of different views about American politics. Kessler

PS 569 Topics in Political Theory. Preq: Sr. or grad. standing. (Maximum of 6 hours may be taken). 3(3-0) F,S. A close examination of particular topics or theorists that are not included in the basic courses in political theory. Course content changes in different years, and, with permission of instructor, the course may be repeated for credit. Examples of course topics are: "Foundations of Modern Radicalism," "Twentieth Century Political Philosophy and Political Science," "Political Philosophy and the Problem of Law," and "Origins of Political Science." Kessler

PSYCHOLOGY

PSY 200 Introduction to Psychology. 3(3-0) F,S,Sum. General characteristics of human behavior, including motivation, learning, development, thinking, perception, sensation and measurement. The objectives are: development of the ability to communicate in oral and written form accurately and scientifically about behavior; development of an understanding of and a capacity to use scientific ideas and processes as they apply to behavior; an understanding of the behavior of organisms. Cunningham, Kalat

PSY 210 Psychological Analysis Applied to Current Problems. Preq: PSY 200. 3(3-0) F,Sum. Explores the psychological bases of certain current social problems. Emphasis is on review of pertinent literature and planning simple research projects. Problems studied from a set of relevant problems: violence and aggression, equal rights for women, attitude change, rehabilitation, population growth, service delivery systems, etc. The interests and abilities of students and teacher and availability of literature will be the principal criteria for problem selection. Juniors and seniors are advised to take PSY 412 rather than PSY 210. Smith

PSY 300 Perception. Preqs: PSY 200, introductory BS, CH or PY recommended. 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 psycho-physics. 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. Introduction to a model of instruction through readings, group activities, and class discussions. Engages student in activities which employ some concepts of educational psychology. Staff

PSY 310 Learning and Motivation. Preq: PSY 200. 3(3-0) F,Sum. Acquaints students with the structure of the areas of learning and motivation and with the major theories and empirical findings in these areas. Develops skill in deriving and testing implications of theories and in manipulating theoretical concepts. Cole

PSY 320 Cognitive Processes. Preq: PSY 200. 3(3-0) F,S,Sum. Complex cognitive processes such as: thinking, reasoning, problem solving, creativity and originality, intelligence, social interaction, verbal behavior and decision processes. Emphasis on theoretical approaches, research findings. Aims at developing skills in deriving and testing hypotheses in these areas. Newman

PSY 337 Psychology, Industrial Society and Social Policy. Preq: PSY 200. 3(3-0) F.S. Current problem areas in human resource development for modern technological societies are considered, emphasizing systems approaches as a unifying concept. General systems concepts, methods of industrial psychology, human resource development and social psychology are jointly introduced and their implications considered. Policy formulation, analysis, implementation, evaluation, feedback, and citizen participation are stressed. An exemplary human resource development system is defined; procedures for analysis, evaluation and for possible design alternatives are explored in the context of modern urban-industrial societies. Cunningham

PSY (IE) 338 Human Factors in Equipment Design. Preq: PSY 337 or IE 332. 3(2-2) F. An introduction to methodology in human factors research, equipment design, biomechanics, and accident study. Man's sensory, motor, and decision-making abilities are related to problems of systems design, operator efficiency, and safety as these involve displays, controls, workplace layout, and environmental stressors. Pearson

PSY 350 Interviewing and Behavior Observation Skills. Coreqs: PSY 351, 352, SP 110. 4(2-6) F. Instruction and practice in interviewing. Developing skill in behavior observation with children of all age levels and with adults, particularly those from disadvantaged and varied cultural backgrounds. Use of communications and instructional media such as video tape, audio tape, and varied observational techniques and instruments. Cowgell

PSY 351 Instructional Skills. Coreqs: PSY 350, 352, SP 110. 4(2-6) F. Development of skills in the psychology of instructing, tutoring, instructional programming, and instructional communication. Emphasis on disadvantaged learners, problems of measurement, evaluation, and test construction. Cowgell

PSY 352 Organizational Skills. Coreqs: PSY 350, 351, SP 110. 4(2 6) F. Topics are: 1) Current theories of organizational structure and process applicable to human serving organizations, 2) problems associated with change and intervention in human serving organizations, 3) recognition and determination of organizational goals, and 4) organizational gaming. Cowgell

PSY 370 Psychology of Personality and Adjustment. Preq: PSY 200. 3(3-0) F,Sum. Mechanisms influencing human behavior related to crisis resolution, effective adjustment and personal fulfillment. Includes a supervised group interaction laboratory and a major semester problem as well as lectures and examinations. Green

PSY 376 Human Growth and Development. Preq: PSY 200 or 304. 3(3-0) F,S. Study of behavioral development during the human life span through 1) studying current theories and 2) working with persons at various stages of the life cycle. Student problems require applications of concepts drawn from developmental psychology. Staff

PSY 400 Perception: Research Methods. Preq: PSY 300; Coreq: ST 311. 3(1-4) S. Alt. yrs.

The various methodologies and research strategies currently employed in the area of perception. Includes extensive individual experience in the perception research laboratory, readings of both methodology and experimental research, and the conduct of an independent project of original design within the area of perception. Mershon

PSY 410 Learning and Motivation: Research Methods. Preq: PSY 310; Coreq: ST 311. 3(1-4) S. The various methodologies and research strategies currently employed in learning and motivation. Includes extensive individual experience in the activities of the Operant laboratory, readings on both methodology and experimental research, and the conduct of an independent project of original design within the area of learning and motivation. Cole

PSY 411 Social Psychology. Preq: PSY 200. 3(3-0) F,S. A study of the importance of social factors for the behavior of individuals. Topics include affiliation, interpersonal attraction, person perception, attitude formation and change, conformity, and altruistic behavior. Luginbuhl

PSY 412 Psychological Research Applied to Current Problems. Preqs: PSY 200 and ST 311. 3(3-0) S. Emphasis from a psychological perspective is given to application of conceptual and technical skills relevant to understanding and acting on social problems. Basic material will include: governmental agencies and social action, models of behavior systems, research techniques and computer-based data processing. Specific social problems will be selected for class demonstration projects. The interests and abilities of students and teacher will be the principal criteria for project selection. Smith

PSY 420 Cognitive Processes: Research Methods. Preq: PSY 320; Coreq: ST 311. 3(1-4) F. The various methodologies and research strategies currently employed in cognitive processes. Extensive individual experience in the activities of the Cognition Research Laboratory, readings on both methodology and experimental research, and the conduct of an independent project of original design within the area of cognitive processes. Newman

PSY 430 Neuropsychology: Research Methods. Preqs: PSY 400, 410, 420; or CI. 3(1-4). The various methodologies and research strategies currently employed in neuropsychology. Includes extensive individual experience in the activities of the Neuropsychology laboratory, and readings on both methodology and experimental research. LeVere

PSY 475 Child Psychology. Preq: PSY 200 or 304. 3(3 0) F. Emphasis upon the intellectual, social, emotional and personality development of the child. Physical growth emphasized as necessary to an understanding of the psychological development of the pupil. Staff

PSY 476 Psychology of Adolescent Development. Preq: Junior standing. 3(3-0) F,S. Considers adolescent behavior as part of the development sequence of human behavior with emphasis on the adolescent experience in Western culture and implications for the instruction of adolescents. Chmielewski, Makoid, Taylor

PSY 491 Research Methods in Psychology. Preq: PSY 200. Only for majors in PSY, HRD, and PEO. 3(3-0) F,S. Basic methods used in psychological research; design of empirical investigations, both laboratory and field; ethical issues in the conduct of research; concepts of measurement and data analysis; experience in reviewing past research, in conducting investigations and in writing scientific reports. Examples from a wide range of content areas of psychology will be used. Klein

PSY 492 Seminar in Psychology. Preq: PSY 491. Only for majors in PSY, HRD, and PEO. 3(1 5) F,S,Sum. Seminar and independent study under faculty direction. Provides the undergraduate psychology major with opportunity to practice skills in designing, conducting, and evaluating research. The student, working closely with a faculty advisor, will design a research approach to a particular body of literature, will accumulate appropriate data, and will analyze and evaluate the data. Staff

PSY 493 Special Topics in Psychology. Preq: CI. 1-6 F,S. An individual study course. Any undergraduate student may suggest an activity (review of literature on a topic, designing and conducting an experiment, or survey, etc.). After discussion if both student and supervising professor agree the topic is worthwhile, that the student is competent to undertake it, the student will enroll the following semester. Staff

PSY 495 Human Resource Development Practicum. Preqs: Jr. standing. PSY HRD op-

tion, PSY 350, 351, 352, SP 110. 8(0-8) F,S. Field experience in the use of skills acquired during the skill semester. The student will spend at least a full semester working in a selected off-campus center. The student experiences real world problems in context, and can arrange later course work around subjects applicable to the solution of such problems. Cowgell

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. First of two semester sequence concerned with the physiological foundations of behavior. The emphasis in this first course is basic vertebrate neuroanatomy and neurophysiology. LeVere

PSY 504 Advanced Educational Psychology. Preq: Six hours of PSY. 3(3-0) F,S. A critical appraisal of current psychological findings that are relevant to educational practice and theory. Staff

PSY 505 History and Systems of Psychology. Preqs: PSY 200, 300, 310, 320 or CI or grad. status. 3(3-0) S. The aim of this course is to acquaint students with the history of psychology and psychological systems and to give students some practice in taking different approaches to a particular problem area. Cole

PSY 511 Advanced Social Psychology. Preq: Grad. standing or CI. 3(3-0) F. A survey of theory and research in social psychology through reading and discussion of primary source materials. In addition, the course will deal with issues of methodology, ethical questions in social psychological research and application of research findings to the world at large. Klein, Luginbuhl, Smith

PSY 530 Abnormal Psychology. Preqs: PSY 200, 302. 3(3-0) S. The causes, symptomatic behavior and treatment of the major personality disturbances. Emphasis on theory, experimental psychopathology and preventive measures. Corter, Green

PSY (ED) 531 Mental Retardation. 3(3-0) F,Sum. (See education courses.)

PSY 532 Psychological Aspects of Exceptionality. Preq: CI. 3(3-0) S,Sum. The course is designed to give consideration to effects of severe deficiency (sensory, physical, mental, etc.) arising from any causes at any stage of life; the personal and social ramifications of these; and possible courses of intervention; as well as utilization of psychological theory and clinical information in interpreting probable implications. Research findings related to sensory deprivation, research needs and possible research projects will be discussed. Rawls

PSY 535 Tests and Measurements. Preq: Six hours of PSY. 3(3-0) F,S,Sum. A study of the principles of psychological testing including norms and units of measurement, elementary statistical concepts, reliability and validity. In addition, some attention is devoted to the major types of available tests such as general intellectual development, tests of separate abilities, achievement tests, measures of personality and interest inventories. Westbrook

PSY (IE) 540 Human Factors in Systems Design. Preq: IE (PSY) 338 or IE 354; Coreq: ST 507 or 515. 3(3-0) S. Introduction to problems of the systems development cycle, including man-machine function allocation, military specifications, display-control compatibility, the personnel sub-system concept and maintainability design. Detailed treatment is given to man as an information processing mechanism. Pearson

PSY 571 Individual Intelligence Measurement. Preq: PSY 570. 3(3-0) S. A practicum in individual intelligence testing with emphasis on the Wechsler Bellevue, Stanford-Binet, report writing and case studies. Green

PSY 576 Developmental Psychology. Preq: Nine hours of PSY, including PSY 475 or PSY 476. 3(3-0) F. A survey of the role of growth and development in human behavior, particularly during the child and adolescent periods. This course will pay particular attention to basic principles and theories in the area of developmental psychology. Rawls, Corter

PSY 578 Individual Differences. Preq: Six hours of PSY. 3(3-0) S. The objective and quantitative investigation of individual differences in behavior. The course deals with the following questions: What is the nature and extent of individual differences? What can be discovered about their causes? How are the differences affected by training, growth, and physical conditions? In what manner are the differences in various traits related to one another, or organized? Westbrook

PSY 591 Special Topics in Psychology. Preq: 6 hours of PSY; Coreq: 3 hours of ST. 1-3 F.S. Course will provide opportunity for exploration in depth of advanced areas and topics of current interest. Graduate Staff

PSY 594 Area Seminar in Human Resources Development. Preq: Cl. 1-3, Maximum 6 F.S. The following topics will be dealt with: (1) human resources development as an area of inquiry, (2) methods of inquiry, (3) contemporary issues, (4) ethical questions, (5) relationship to other areas within psychology. Graduate Staff

VISUAL DESIGN

(Also see Design; and PD courses under Product Design.)

PVD 400 Intermediate Visual Design (Series). Preq: DF 102. May not be taken more than six times. 6(0-9) F.S. Investigations of visual environment through the agency of various materials and processes leading to professional competence. Students select from a number of vertically organized workshop studios which offer on an optional basis a wide range of program emphases.

PHYSICS

PY 101 Perspectives on Physics. 1(1-0) F. An orientation in the current practice of physics, including discussion of historical background, scientific viewpoint, current topics, and careers in physics. Visits to departmental research laboratories. Staff

PY 201, 202, 203 General Physics. Preq: MA 102. 4(3-3) F,S. Intended primarily for majors in physical and mathematical sciences and nuclear engineering. Staff

PY 205, 208 General Physics. Preq: MA 102. 4(3-3) F,S,Sum. Required in most engineering curricula. A study of classical and modern physics in which the analytical approach is employed. Demonstration lectures, recitations, problem drill and laboratory work give a working knowledge of basic principles. PY 205, mechanics, sound and heat; PY 208, electricity, light and modern physics. Staff

PY 211, 212 General Physics. Preq: (211) MA 111 or 116; (212) PY 211. 4(3-2) F,S,Sum. Designed to provide a basic though not specialized knowledge of physics. Lecture-demonstration, recitation and laboratory give a working familiarity with basic principles of mechanics, heat, sound, electricity, light and modern physics. Staff

PY 221 College Physics. Preq: MA 111 or 115. 5(5-0) F,S,Sum. Fundamental principles applied to modern science and technology. Important concepts in the classical areas of physics, along with a brief survey of modern atomic physics. Lectures and demonstrations with class participation. Staff

PY 223 Astronomy. 3(2-2) F,S. An introductory, descriptive survey designed primarily for the non science major, but open to all. Discussion of such recent spectacular advances in astronomy as space probes, pulsars, quasars, black holes, etc. Laboratory opportunities for direct observation of celestial objects and for experiments demonstrating the methods and techniques of astronomical research. Owen

PY 231 Physics for Non-Scientists. For humanities and social science students only. 3(3-0) F,S,Sum. An elementary course for non-science students. 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. Staff

PY 232 Physics in Contemporary Society. Preq: PY 231 or 221 or 201-202 or 205-208 or 211 212. 3(3-0) F,S. A look at how our surroundings can be influenced and understood in terms of basic physical principles. Topics include energy sources (e.g., nuclear, solar, etc.), purposes of orbiting satellites, space travel and relativity, as well as applications of physics to medical, biological and environmental problems. Emphasis on "Trans-Science", where science and society interact. Topics depend on student interest. Seagondollar

- PY 240 Exophysics.** Preq: MA 111 or equiv. 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. Mitchell
- PY 245 Physical Principles of Photography.** Preqs: PY 203 or 208 or 212 or 221 or 231; CH 101 or 111. 3(2-3) S. The physics and chemistry of the photographic process. Students must furnish their own cameras. Cobb
- PY 401, 402 Modern and Quantum Physics, I, II.** Preq: PY 411. 3(3-0) F,S. The basic theories of modern physics, particularly relativity and quantum mechanics. Application of these theories to atomic structure, optical spectra, x rays, nuclear physics, solid state physics and elementary particles. Parker
- PY 407 Introduction to Modern Physics.** Preqs: MA 202, PY 208. 3(3-0) F,S. The important developments in atomic and nuclear physics this century. Topics include: an introduction to special relativity, atomic and molecular structure, determination of properties of ions and fundamental particles, the origin of spectra, and nuclear reactions. Staff
- PY 410 Introductory Nuclear Physics.** Preq: PY 203 or 407. 4(3 2) S. The properties of the nucleus, and the interaction of radiation with matter. A quantitative description of natural and artificial radioactivity, nuclear reactions, fission, fusion and the structure of simple nuclei. Waltner
- PY 411, 412 Mechanics I, II.** Preqs: PY 203 or 208, MA 301. 3(3-0) F,S. Intermediate theoretical mechanics of particles, systems of particles, fluids, and moving reference systems. The first course emphasizes the Newtonian formulation; the second introduces the Lagrangian and Hamiltonian viewpoints. Mowat
- PY 413 Thermal Physics.** Preq: PY 202 or 208; Coreq: MA 301. 3(3-0) S. An introduction to the statistical study of macroscopic systems. First principles of heat and thermodynamics are reviewed. Subsequent topics covered include basic concepts of probability, the macroscopic states of large systems, the concepts of temperature, heat, and entropy, and the relation between these quantities. Klenin
- PY 414, 415 Electricity and Magnetism I, II.** Preqs: PY 203 or 208, MA 301. 3(3-0) F,S. An intermediate course in the fundamentals of static and dynamic electricity and electromagnetic theory, developed from basic experimental laws. Vector methods are introduced and employed throughout the course. Mitchell
- PY 441 Spacetime Physics.** Preq: PY 203 or 407. 3(3-0) F. An elementary introduction to the concepts and problems of spacetime physics in accord with Einstein's special theory of relativity. Historically interesting problems, e.g., the so-called clock or twin paradox, and modern problems treated by the application of the conservation laws of momentum and energy in the natural geometry of spacetime. Davis
- PY 451, 452 Intermediate Experiments in Physics I, II.** Coreqs: PY 411, 414. 2(1-3) F,S. Experiments in mechanics, electricity and magnetism, and modern physics. Haase
- PY 499 Special Problems in Physics.** Preq: Consent of department. 1-3 F,S. Study and research in classical and modern physics. Topics for experimental or theoretical investigation, or a literature survey. Staff
- Selected 500-Level Courses Open To Advanced Undergraduates*
- PY 506 Nuclear Physics I.** Preqs: PY 203 or 407; PY 412. 4(3-2) F. Nuclear properties and phenomena such as alpha, beta and gamma decay, accelerator-induced nuclear reactions and fission. Emphasis on experimental techniques for probing nuclear structure and interpretation of results in terms of current theories. Gould
- PY 508 Ion and Electron Physics.** Preq: PY 414. 3(2-2) S. Topics include collision processes, electron emission, charged particle dynamics, gaseous discharges, and the physics of ion and electron beams. Kim
- PY 509 Plasma Physics.** Preq: PY 414. 3(3-0) F. The individual and collective motion of charged particles in electric and magnetic fields and through ionized gases. Doggett

- PY 510 Nuclear Physics II.** Preq: PY 410. 4(3-2) S. The properties of the atomic nucleus as revealed by radioactivity, nuclear reactions and scattering experiments with emphasis on the experimental approach. The laboratory stresses independent research and offers project work in nuclear spectroscopy and in neutron physics. Waltner
- PY (NE) 511 Nuclear Physics for Engineers.** Preq: PY 410. 3(3-0) F. The properties of atomic nuclei, of nuclear radiations and of the interaction of nuclear radiation with matter. Emphasis on the principles of modern equipment and techniques of nuclear measurement and their application to practical problems. Waltner
- PY 516 Physical Optics.** Preq: PY 415. 3(2-2) F. Emphasis on the wave properties of light. Subjects include boundary conditions, optics of thin films, interference and diffraction, applications to absorption, scattering, and laser operation. A background in Maxwell's equations and vector analysis is required. Schetzina
- PY 517 Atomic and Molecular Physics.** Preqs: PY 401, 412. 3(3-0) S. The quantum mechanical treatment of structure and spectra for atoms and molecules. Topics include the hydrogen atom, helium atom, multielectron atoms, selection rules, diatomic and simple polyatomic molecules, and nuclear magnetic resonance spectroscopy. Risley
- PY 520 Measurements in Nuclear Physics.** Preq: PY 410. 3(2-2) S. Fundamentals of statistics (including the binomial, normal, Poisson and interval distributions) as applied to the analysis of measurements on nuclear reactions and radioactivity. Waltner
- PY 521 Statistical Physics I.** Preqs: PY 401, PY 413. 3(3-0) S. The basic elements of kinetic theory and equilibrium statistical mechanics, both classical and quantum; applications of the techniques developed to various ideal models of noninteracting particles. Lado
- PY 543 Astrophysics.** Preqs: PY 203 or 407; PY 411. 3(3-0) S. The basic physics necessary to investigate, from observational data, the internal conditions and evolution of stars. Topics include the formation and structure of spectral lines, methods of energy generation and transport, stellar structure, degeneracy, white dwarfs and neutron stars. Danby
- PY 552 Introduction to the Structure of Solids.** Preq: PY 401. 3(3-0) S. Basic considerations of crystalline solids, metals, conductors and semiconductors. Sayers
- PY (MA) 555 Mathematical Introduction to Celestial Mechanics.** 3(3-0) F. (See mathematics.)
- PY (MA) 556 Orbital Mechanics.** 3(3-0) S. (See mathematics.)
- PY 581, 582 Quantum Mechanics I, II.** Preqs: MA 512; PY 411 or 414; grad. standing or permission of the graduate administrator. 3(3-0) F,S. Fundamental concepts and formulations, including interpretation and techniques, and the application of theory to simple physical systems, such as the free particle, the harmonic oscillator, the particle in a potential well and central force problems. Other topics include approximation methods, identical particles and spin, transformation theory, symmetries and invariance, and an introduction to quantum theory of scattering and angular momentum. Johnson
- PY 583, 584 Advanced Classical Mechanics, I, II.** Preqs: MA 512, PY 412, PY 414; grad. standing or permission of the graduate administrator. 3(3-0) F,S. An introduction to theoretical physics in preparation for advanced study. Emphasis is on classical mechanics, special relativity and the motion of charged particles. Topics include variational principles, Hamiltonian dynamics and the canonical transformation theory, structure of the Lorentz group and elementary dynamics of unquantized fields. Jenkins, Katzin
- PY 585, 586 Advanced Electricity and Magnetism I, II.** Preqs: PY 415; grad. standing or permission of the graduate administrator. 3(3-0) F,S. Topics include: techniques for the solution of potential problems, development of Maxwell's equations; wave equations, energy, force and momentum relations of an electromagnetic field; covariant formulation of electrodynamics; radiation from accelerated charges. Chung
- PY 599 Senior Research.** Preq: Sr. honors program standing, except with special permission. 3(3-0) F,S. Investigations in physics under staff guidance. May consist of literature reviews, experimental measurements or theoretical studies. Graduate Staff

RELIGION

(Also see Philosophy.)

REL (FLH) 101 Elementary Biblical Hebrew I. 3(3-0) F. Alt. yrs. 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 is given to exegetical method.

VanderKam

REL (FLH) 102 Elementary Biblical Hebrew II. Preq: REL (FLH) 101. 3(3-0) S. Alt. yrs. A continuation of REL (FLH) 101 with increased emphasis upon reading selected prose passages.

VanderKam

REL (FLH) 201 Intermediate Biblical Hebrew I. Preq: REL (FLH) 102. 3(3-0) F. Alt. yrs. 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 in connection with the readings.

VanderKam

REL 298 Special Topics in Religion. 3(3-0) F.S. 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.

Staff

REL 300 Introduction to Religion. 3(3-0) F.S.Sum. An analysis of various aspects of religion such as the development of the great traditions, as well as the relation of religion to personal maturity, cultural change, and the social good.

Staff

REL (SOC) 309 Sociology of Religion. Preq: Three hours of sociology. 3(3-0) S.Sum. (See sociology.)

REL 311 The Hebrew Bible. 3(3-0) F. An exploration of the varied Biblical literature of the Hebrews. The course stresses the development of their religious faith and tradition, but such background matters as geography, archeology, history, and literary problems are also considered.

VanderKam

REL 312 Christian Origins. 3(3-0) S.Sum. An examination of the Biblical writings of the early Christian community in their historical context. The results of recent studies of the Dead Sea Scrolls as well as of Hellenistic and Hebrew thought and religion are brought to bear on early Christian life and thought.

VanderKam

REL 315 Western Religions to the Reformation. 3(3-0) F. The major steps in the development of Christianity and Judaism during the period 100-1500 A.D., noting the events, persons, and ideas which were most significant in this development.

Fitzgerald

REL 316 Western Religions Since the Reformation. 3(3-0) S. The major developments within Christianity and Judaism from 1500 to the present.

Fitzgerald

REL 321 Religion in American Life. 3(3-0) F.S. A study of representative men, movements, and thought in the major religions within the context of American society and culture.

Moorhead

REL 323 Religious Sects in America. 3(3-0) S. An investigation of various sects and minority faiths in America including Mormonism, Christian Science, Jehovah's Witnesses, and the holiness-charismatic movement. The course traces the origins, development, and teaching of these groups and places them within the context of American culture and religion.

Moorhead

REL 325 Religion and Literature. 3(3-0). An examination of the relationship between religion and literature exploring a variety of options on such themes as the problem of evil and suffering and the quest for meaning in human existence.

Tolbert

REL 327 Contemporary Religious Thought. 3(3-0) F.S. An examination of recent religious and theological thought in America and Europe as it has responded to the rapidly changing intellectual, scientific, and social dimensions of Western culture.

Fitzgerald, Stalnaker

REL 331 Hinduism and Islam. 3(3-0) F. The religious traditions of India, including early Vedic religion, Brahmanism, the various Yogas, the devotion cults, the religio-philosophical

traditions, and modern religious movements. Islam is examined in its Arabian origin and as it has developed in other parts of the world.

Highfill

REL 332 Buddhism. 3(3-0) S. Buddhism is followed from its beginnings in India through the expansion into the whole of Asia. Creativity in art, political involvements, and meditative disciplines, as in Zen, are some of the facets considered.

Highfill

REL 498 Special Topics in Religion. Preq: Six hours REL. 1-6 F,S. This course is used to offer areas of study that appear only rarely in the curriculum. It will also function as a readings course for honors students in religion.

Staff

RECREATION RESOURCES ADMINISTRATION

RRA 101 Recreation Resources Orientation Laboratory. Coreq: RRA 152. 1(0-3) F,S. Introduction to the Department of Recreation Resources Administration, to the profession of park and recreation services, and in the career opportunities in the delivery of these services.

Staff

RRA 152 Introduction to Recreation. 3(3-0) F,S. History and foundations of recreation including objectives, economic and social aspects, definition and importance; status of organized recreation in our modern society; certain applied principles of recreation.

Staff

RRA 215 Maintenance and Operations I. Preq: RRA 152. 3(3-0) F,S. Methods of operation of various park and recreation facilities for public use; protection and law enforcement; job planning and scheduling; preventive maintenance; and modern maintenance techniques and maintenance materials.

Sternloff

RRA 216 Maintenance and Operations II. Preq: RRA 152. 3(3-0) F,S. Emphasis upon water-oriented recreation and public camping facilities; swimming pools; beaches; small lake management; marinas; day and family camping.

Staff

RRA 241 Recreation Resource Relationships. Coreq: RRA 152. 3(3-0) F,S. The concepts and principles involved in identifying and describing natural recreation resource components significant to management. The relationships between various governmental agencies and private enterprise in providing forest recreation.

Staff

RRA 341 Principles of Recreation Planning. Preq: RRA 241. 3(2-2) F,S. The recreation administrator's role in planning situations typical of the public and private sectors. Categories of information and their significance in the decision-making and problem-solving process. Competent information systems.

Rea

RRA 353 Public Camp Administration. Preq: RRA 152. 3(2-2) S. Development of organized camping and its educational, health and recreational objectives. Program planning and leadership training in community, private, agency and school camping. Laboratory campercraft skills.

Warren

RRA 354 Health Practices in Recreation Management. 3(3-0) F. Emphasis upon health problems, disease prevention, communicable diseases and their control, public health administration, school and industrial hygiene, and other health problems confronting the individual and community.

Staff

RRA 358 The Recreation Program. Preq: RRA 216. 4(2-4) F,S. Types of recreation opportunities available to individuals, groups, neighborhoods or municipalities and the methods of providing these opportunities.

Wilson

RRA 359 Recreation and Park Supervision. Preq: RRA 358. 3(2-2) F,S. Directing, inspecting and critical evaluation. Emphasis on the roles of the public recreation supervisor, community centers, sports, special activities, maintenance and operation.

Kirsch

RRA 442 Wildland Recreation Environments. Preq: Jr. standing. 3(2-3) F,S. Environmental modifications and resource developments required to support recreation use. Factors affecting site selection are related to resource planning functions. Site planning procedures provide a basis for managerial review. Natural history interpretation is an element of resource management. Concepts of natural beauty and approaches to preservation of amenities through modified methods of commercial product management.

Wilson

RRA 451 Facility and Site Planning. Preq: RRA 341. 3(2 3) F.S. The history of park and recreation facility development and trends in recreation facility planning. Emphasis upon the planning principles in design and layout of recreation areas and buildings. Field trips to various types of recreation facilities.
McKnelly

RRA 453 Administrative Policies and Procedures. Preq: RRA 359. 3(3-0) F.S. The internal organization of the recreation and park department; the administrative process; legislation and legal foundations; boards and commissions; personnel practices and policies; office management, public relations.
Sternloff

RRA 454 Recreation and Park Finance. Preqs: Six hours RRA, sr. standing. 3(3-0) F.S. Recreation and park fiscal administration; sources of finance for current and capital expenditures; revenue activities; financial planning; budgeting; expenditure policies; accounting; auditing and planning for recreation and park services.
Kirsch

RRA 475 Recreation and Park Internship. Preq: Sr. standing, RRA 359. 9(0-27) (9 weeks) S,Sum. Provides prospective recreator with an opportunity for controlled experiences in skills and techniques involved in recreation and park department management. The student spends nine weeks off campus in a departmental selected location.
Staff

RRA 491 Special Problems in Recreation. Preq: Consent of department. Limited to accumulative total of 6 credit hours. 1-6 F.S. Aims to develop critical analysis. Forms a basis for the organization of research projects, for the compilation and organization of material in a functional relationship and for the foundation of policies. Seminar procedure.
Tarbet

Selected 500-Level Courses Open To Advanced Undergraduates

RRA 500 Theories of Leisure and Recreation. Preq: Nine hours of RRA courses. 3(3-0) F. Analysis of leisure and recreation and a study of their origin and development as revealed by man's behavioral patterns. Interpretation of the influence and social significance of leisure and recreation concepts on contemporary American culture and their implications on future recreation thought and action.
Warren

RRA 501 Theory Development in Recreation Research. Preqs: ST 311 and SOC 416. 4(3-2) S. Review of the historical emphasis on recreation research with analyses of various approaches to research design and model building. Examination of the philosophy of social scientific investigation, and possible application of existing behavioral theory to recreation research with a special emphasis on efforts to develop theory useful in explaining use of leisure time.
Siderelis

RRA (EB) 503 Economics of Recreation. Preq: EB 301 or 401. 3(3-0) F. The principal emphasis will be on identity and importance of economic information for planning. The market mechanism and government will be examined as they affect and interact to affect allocation of resources to recreation, distribution of recreation services, and behavior of recreationists. Other topics include demand analysis, economics of planning, cost/benefit analysis, secondary economic impacts, public decision-making, externalities, public finance, and supply considerations in urban and rural recreation situations.
Devine

RRA 504 Recreation and Park Data Systems. Preqs: CSC 200, ST 311; Coreq: RRA 453. 3(3-0) F. This course includes the analysis of such topics as the identification of maintenance, operation, and service delivery work areas in recreation and park agencies for system applications; development of reporting structures and report generation; recreation and maintenance activity scheduling; system monitoring; forms design and control; system implementation, and system evaluation.
Siderelis

RRA 538 Recreation for Special Populations. 3(3-0) S. Emphasis on the leisure concerns of deprived groups with exposure to the 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.
Sternloff

RRA 591 Recreation Resources Problems. Preq: Advanced undergrad. or grad. status. 1-4 F.S. Assigned or selected problems in the field of recreation administration, planning, supervision, maintenance, operations, financing, or program. Special research problems selected on basis of interest of students and supervised by members of the graduate faculty.
Graduate Staff

SOCIOLOGY

(Also see Anthropology.)

SOC 202 Principles of Sociology. 3(3-0) F,S,Sum. Introduces basic ideas in the field of sociology. Exposure to a variety of concepts, theories and research findings develops student's abilities to conceptualize, analyze and interpret patterns of human interaction from a sociological perspective.

SOC 203 Current Social Problems. 3(3-0) F,S,Sum. Examines the concept of social problems with emphasis on the problem orientation of contemporary United States society. Investigates the social and cultural aspects of problems to demonstrate the basic integration of society and community life. Problems for intensive study vary to reflect current interests and may include crime, divorce, race conflict, illness, poverty, housing, recreation, personality adjustment, population and social aspects of environmental crisis.

SOC 204 Contemporary Family Life. 3(3-0) F,S,Sum. The American family as a social institution as an interaction process with emphasis on mate selection, marital adjustment, socialization and marital dissolution.

SOC 205 Work: Occupations and Professions. 3(3-0) F,S,Sum. The sociology of occupations, professions and work, especially human relations in industrial plants and other work situations.

SOC 241 Rural Society U.S.A. 3(3 0) F,S. Major rural social institutions, ecological patterns and land tenure systems are examined emphasizing the American setting. Influence of rural patterns and values in contemporary urbanized society. Stresses the role of the rural community as an area of institutional functioning and social integration within the framework of a complex, industrial society.

SOC 301 Human Behavior. Preq: SOC 202 or PSY 200. 3(3 0) F,S,Sum. Examines effects of social interaction upon individual behavior and personality and collective attitudes and behavior as products of group experience. Analyzes fashions and fads, crowds, mobs, publics, social movements.

SOC 302 Mass Communications and Modern Society. Preq: Three cr. in SOC. 3(3-0) F,S. Introduction to the sociology of mass communications including its process, content, audiences, communicators, and social effects in modern society. The preparation of a news media comparison report enables critical examination of local and national media content. Provides insight from classic works by sociologists and other social scientists.

SOC 305 Race Relations. Preq: Three cr. in SOC. 3(3-0) F,S,Sum. Analyzes race relationships both in the United States and throughout the world with emphasis on factors producing current changes.

SOC 306 Criminology. Preq: Three cr. in SOC. 3(3-0) F,S,Sum. The study of the processes whereby behavior is defined as crime and persons are identified as criminals including 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 Sociology of Religion. Preq: Three hours of Sociology. 3(3-0) S,Sum. Examines the role of religion in the organization and operation of social systems. Particular emphasis is on the functions of belief networks and of their institutional expressions. Religious institutions are studied to understand their influence on other significant social systems such as political, educational, legal, economic, and family systems.

SOC 311 Community Relationships. Preq: Three cr. in SOC. 3(3-0) F,S. A survey of the institutions, organizations and agencies found in modern communities; social problems and conditions with which they deal; their interrelationship and the trend toward over all planning.

SOC 313 Sociology of Health. Preq: Three cr. in Sociology. 3(3-0) 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.

SOC (ED) 318 Introduction to the Sociology of Education. Preq: Three hours of basic sociology. 3(3-0) F.S. An investigation of the United States educational institution in a sociological framework. Analyzes the objectives of education, the school as a social system, the roles and role relationships of various position occupants, and the effects of social factors including social class and organizational expectations upon the educational experience within a framework of the characteristics and influences of a bureaucratic organization.

SOC 342 Rural Societies Around the World. Preq: SOC 202 or SOC 241. 3(3-0) S. Sociological description, analysis and understanding of traditional rural societies of Asia, Africa and Latin America. Basic social institutions, groupings and processes provide bases for understanding these societies in the context of an increasingly urbanized and industrial world. Stresses examination of these societies on a Gemeinschaft-Gesellschaft continuum.

SOC 351 Population and Planning. Preq: Three cr. in SOC. 3(3-0) F.S. Growth rates, changing composition and residential redistribution in relation to public issues and planning. Studies the ways in which population data are utilized by public agencies in program and policy formulation. Analysis encompasses new problems and socioeconomic situations resulting from the dynamic nature of population changes in contemporary society.

SOC 402 Urban Sociology. Preq: SOC 202. 3(3-0) F.S. Analyzes urban social structures emphasizing determinants and consequences of changes in urban places and life styles. Understanding current urban problems as reflecting existing situations and changes occurring in the larger society. Examines various approaches to urban social planning.

SOC 410 Formal Organizations. Preq: SOC 202. 3(3-0) F. This course examines why and how formal organizations for example, businesses, industrial firms, civic clubs, professional and religious associations are created, developed, maintained, changed, and destroyed. Topics include alternative theoretical perspectives, methodological considerations, organizational structure, groups within organizations, organizational environments, and future prospects.

SOC (PS) 413 Criminal Justice Field Work. Preq: Acceptance in criminal justice option; senior standing, SOC 306 and PS 311. 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 through participation in weekly seminars as well as preparation and presentation of integrative report.

SOC 414 Social Class. Preq: SOC 202. 3(3-0) F. Examines the universality of structured inequality, the criteria for assignment and the causes and consequences of vertical differentiation. Relates social class to life chances, life styles and mobility and to other forms of social stratification. Investigates theories and research methods pertinent to the study of social class.

SOC 415 Social Thought. Preq: SOC 202. 3(3-0) F.S. A course dealing with the growth of social thought from a philosophical to a scientific perspective, from social philosophy to scientific sociological theory. Emphasis is on the understanding of major sociological theories and their intellectual and philosophical antecedents; philosophical and methodological issues relevant to the development of sociological theories; and the relationship between theory and research.

SOC 416 Research Methods. Preq: Sr. standing, ST 311, or CI. 3(3-0) F.S. The basic methods of social research, research design sampling, data collection, measurement, and analysis; the relation of theory and research.

SOC 418 Analysis of School-Community Relationships. Preq: SOC 202, or 318, or 311, or ED 344. 3(2-2) S. Analyzes the reciprocal relations of school and community, the variant effect of influence sources, and consequences for both school and community. Systematic characteristics and relationships, social change, values, social processes and the American community constitute key analytical variables, implemented by student laboratory experience in school and community.

SOC 420 Sociology of Corrections. Preqs: SOC 306 and PS 311. 3(1-2) S. A variety of correctional settings are studied in sociological perspective. Major topics include: formal and informal organization; inmate social systems; correctional programs and their consequences;

alternatives to confinement; and special purpose facilities. The focus is on contemporary American prison systems with historical and cross-cultural material included for comparative purposes.

SOC 425 Juvenile Delinquency. Preqs: SOC 202, SOC 301 desirable. 3(3-0) F.S. Explores epidemiology of juvenile delinquency. Compares descriptive typologies. Develops theories of causation with emphasis on social institutions, peer groups and socialization processes. Investigates procedures for enforcement, adjudication and correction of young offenders. Examines strategies for prevention of delinquency. Opportunities for observation and participation in agency operations.

SOC 440 Social Change. Preq: SOC 202. 3(3-0) S. Examines sources, processes and consequences of social change on both the macro and micro levels. Employs classical and contemporary theories as well as empirical studies to elucidate historical and modern examples of social change in international, national, regional, community and institutional settings. Studies various methodologies appropriate to each level of analysis.

SOC 441 Social Change in Asia. Preq: SOC 202. 3(1½ 1½) F. The main problems of rapid social change in Asia are examined with regard to the sources, mechanisms, patterns, and consequences of change, utilizing major theoretical perspectives and methodological approaches available in sociology.

SOC 490 Senior Seminar in Sociology. Preq: Sr. standing and consent of department. 3(3-0) F.S. Affords an opportunity to synthesize knowledge, theory and methods learned in earlier courses to a depth study of a substantive or conceptual area.

SOC 498 Special Topics in Sociology. Preq: Six hours SOC above the 200 level. (1-6) F.S. A detailed investigation of a topic in sociology or anthropology. Topic and mode of study determined by the faculty member(s) in consultation with the departmental head.

Selected 500-Level Courses Open To Advanced Undergraduates

SOC (ED) 501 Leadership. Preq: SOC 202 or equivalent. 3(3-0) F.S. Leadership in various fields of American life; analysis of factors associated with it; techniques of leadership. Stresses recreational, scientific and executive leadership procedures. Young

SOC 502 Society, Culture and Personality. Preq: SOC 202 or equivalent. 3(3-0) F.S. Studies human personality from its origins in primary groups through its development in secondary contacts and its ultimate integration with social norms. Explores comparative anthropological materials but places emphasis on the normal personality and individual adjustment to our society and culture. Dynamics of personality and character structure analyzed in terms of society's general culture patterns and social institutions. Uzzell

SOC 504 Education in Modern Society. Preqs: SOC 202, 301 or equivalent. 3(3-0) F.S. Places varying emphasis on the historical development of education in the United States, cross-cultural comparisons of educational structure and function, professionalization of educators, investigation of the ecological factors affecting education, effects of group processes upon learning, and the effects of social processes and changes upon the educational institution. Drabick

SOC 505 Medical Sociology. Preq: Six credits in SOC or grad. standing. 3(3-0) Alt. S. Advanced sociological analysis of health care organizations and their systemic linkage to other community institutions. Measurement of health and illness and their social significance. Applications of sociological and social-psychological theories to practitioner-client relationships and interaction. Implications of alternative models of health care provision. Mustian

SOC 506 The Sociology of Rehabilitation. Preq: Grad. standing and/or CI. 3(3-0) S. Students engage in individual research projects on a specific handicap, a rehabilitation process or a rehabilitative agency or subagency. Lectures and discussions furnish perspective concerning rehabilitation work in process while student pursues a specialized interest. Emphasizes sociological methods and techniques applicable to above aspects of social behavior. Graduate Staff

SOC 507 Social Movements. Preq: SOC 503 or 6 hours of SOC or social psychology. 3(3-0) S. Major topics include: the nature and variety of social movements; conditions affecting the emergence of social movements; the structure of social movements; and the relationship be

tween social movements, social conflict, and social change. While the primary emphasis will be conceptual and theoretical, a number of social movements both past and contemporary will be examined within this framework. Similarly, research issues relative to social movements will be examined.

Graduate Staff

SOC 509 Population Problems. Preq: SOC 202 or equivalent. 3(3-0) F.S. Examines population growth, rates of change and distribution. Emphasizes functional roles of population, *i.e.*, age, sex, race, residence, occupation, marital status, and education. Population dynamics are stressed: fertility, mortality and migration. Population policy is analyzed in relation to national and international goals stressing a world view.

Clifford

SOC 510 Industrial Sociology. Preq: SOC 202 or equivalent. 3(3-0) F.S. Industrial relations are analyzed as group behavior with a complex and dynamic network of rights, obligations, sentiments and rules. This social system is viewed as an interdependent part of total community life. The background and functioning of industrialism are studied as social and cultural phenomena and its social problems are analyzed.

Mercer

SOC 511 Sociological Theory. Preqs: Six hours SOC and grad. standing or CI. 3(3-0) F.S. The interdependence of theory and method; the major theoretical and methodological systems. Examines selected cases of research in which theory and method are classically combined.

Sawhney

SOC 512 Family Analysis. Preq: SOC 202 or equivalent. 3(3-0) F.S. Examines the basic theoretical and methodological framework in sociology within which contemporary family research is conducted.

Mercer

SOC (ED) 513 Community Organization and Development. Preq: SOC 202 or equivalent. 3(3-0) F. Community organization is viewed as a process of bringing about desirable changes in community life. Community needs and resources are studied. Democratic processes in community action and principles of organization are stressed, along with techniques and procedures. Roles of lay and professional workers are analyzed.

Moxley

SOC 514 Developing Societies. Preq: Six hours SOC or ANT or grad. standing. 3(3-0) S. Defines major problems posed for development sociology and explores the social barriers and theoretical solutions for development set forth with regard to the newly-developing countries. Significant past strategies reviewed and main themes in current development schemes presented. Untested strategies for the future proposed and discussed. These problems are examined in their national and international contexts.

Moxley

SOC 515 Deviant Behavior. Preq: Six hours SOC or ANT or grad. standing. 3(3-0) S. Topics include: the inevitability of deviance and its social utility; cross-cultural variations in appearance and behavioral cues for labeling the deviate; descriptive and explanatory approaches to kinds and amounts of deviance in contemporary American society; social change, anomie and social disorganization theories; the process of stigmatization; formal and informal societal responses to deviance and the deviant; social action implications.

Graduate Staff

SOC (PS) 517 The Police Bureaucracy in a Democratic Society. 3(3-0) F.S. (See political science.)

SOC 523 Sociological Analysis of Agricultural Land Tenure Systems. Preq: Three hours SOC. 3(3-0) F. A systematic sociological analysis of the major agricultural and land-tenure systems of the world with emphasis on problems of U.S. family farm ownership and tenancy.

Graduate Staff

SOC 534 Agricultural Organizations and Movements. Preqs: Three hours SOC, American history, American government or a related social science or consent of department. 3(3-0) F.S. A history of agricultural organizations and movements in the United States and Canada principally since 1865, emphasizing the Grange, the Farmers' Alliance, the Populist revolt, the Farmers' Union, the Farm Bureau, the Equity societies, the Nonpartisan League, cooperative marketing, government programs and present problems.

Graduate Staff

SOC 541 Social Systems and Planned Change. Preq: Three hours SOC. 3(3-0) F.S. An examination of social systems within the framework of both functional theory and conflict

theory, with particular emphasis upon system change and the planning of social change.

Marsh

SOC 555 Social Stratification. Preq: Six hours SOC. 3(3-0) F,S. The theoretical background, methodological approaches, and analysis of the consequences of systems of stratification. Emphasizes the static and dynamic qualities of stratification systems on relations within and between societies. Attention to the integrative and divisive quality of stratification as it is expressed in life styles, world views, etc.

Davis

SOC 560 Racial and Cultural Contacts. Preq: Six hours SOC or CI. 3(3-0) F,S. 1) Examines intergroup relations as a legitimate concern of the social sciences, 2) Appraises cross-cultural data drawn from a variety of situations wherein race and ethnicity figure in a significant manner, 3) Attempts to interpret data by delineating observable patterns, trends and relationships.

Graduate Staff

SOC 565 Sociology and General Systems Theory. Preqs: Six hours SOC, one ST course. 3(3-0) F,S. Examines the basis of general systems theory and its application in the sociological fields. Emphasizes the philosophical nature of systems theory and its potential as an alternative conceptualization to mechanistic and organismic models. Scrutinizes the underlying basis of systems theory; cybernetics as models of change and control; learning and equilibrium; information theory as models of choice and selection; decision theory, and game theory.

Graduate Staff

SOC 570 Commitment. Preq: Six hours SOC. 3(3-0) F. The process of commitment and its strength are covered from several theoretical views as applicable to collective behavior, social movements, the sociology of religion, political sociology, deviance, attitudes, decision making, dissonance, structural effects and other topics. An aim is to construct propositions and testable models of the commitment process.

Wimberley

SOC (EB) 574 The Economics of Population. 3(3-0) S. (See economics and business.)

SOC 590 Applied Research. Preq: SOC 202 or equivalent. 3(3-0) F,S. Studies research process with emphasis upon its application to action problems. The development of research design to meet action research needs is stressed.

Mustian

SOC 591 Special Topics in Sociology. Preq: CI. 1-6 F,S. An examination of current problems organized on a lecture-discussion basis. Course content varies as changing conditions require new approaches to emerging problems.

Graduate Staff

SOC 592 Demographic Structure and Processes. Preq: SOC 509 or equivalent. 3(3-0) S. Explores in depth the major demographic variables (size, composition and distribution) and basic demographic processes (fertility, mortality and migration). Attention to theoretical and methodological considerations as well as to current substantive knowledge. Specific course content varies depending upon student needs and interests.

Clifford, Mustian

SPEECH-COMMUNICATION

SP 100 Foundations of Communication Theory. 3(3-0) F,S,Sum. Surveys communication theories in: Public Communication, Interpersonal and Organizational Communication, Theatre, Telecommunications, and Speech Science and Disorders. Demonstrates ways in which various areas in Speech-Communication are interrelated. Camp, Franklin, Leonard

SP 103 Introduction to the Theatre. 3(3-0) F,S. Introduces students to artistic, technical, historical, and literary areas of theatre. Work in acting, directing, design, stagecraft, lighting, costuming, make-up, theatre history, reading and evaluating plays.

Martin, Russell

SP 110 Public Speaking. 3(3-0) F,S,Sum. Basic elements of oral communication. Emphasis on research skills, topic selection, speech organization, skills in speech delivery, and active listening for analysis and evaluation of speeches. Requires a minimum of four graded speeches in class.

Staff

SP 112 Basic Principles of Interpersonal Communication. 3(3-0) F,S,Sum. Surveys interactive communication situations and problems. Exposes students to theories of Interper-

sonal communication, and involves students in various activities pertinent to the understanding of those theories.

Leonard, Stone, Staff

SP 201 Theories of Persuasive Communication. 3(3-0) F,S. Studies ways in which communication influences attitudes and behavior. Examines interaction of speakers, audiences, topics, messages, and occasions as they affect construction and reception of persuasive messages.

Francesconi, Leonard, Rodgers

SP 202 Problem Solving: Group Interaction. 3(3-0) F,S,Sum. Examines communicative behavior of members of small groups as they attempt to identify and analyze a mutual problem, to evaluate possible ways of solving the problem, and to prepare for the implementation of a selected solution. Also examines the dynamic aspects of problem solving interaction through the use of communicative measuring instruments.

Munn

SP 203 Theory and Practice of Acting. 3(3-0) F,S. Introduction to certain contemporary theories on acting and their practical application through classroom participation. Attention is given to role analysis, adaptation of the voice and body to performance demands, and role development through various rehearsal activities.

Russell

SP 205 Speech Improvement. 3(3-0) F,S. Basic processes of the speech production. Attention given to the student's voice quality, articulation, pronunciation, and general vocal expression. Speech improvement: help in recognition and reduction of excessive regional dialect.

Franklin, Parker, Schumacher

SP 211 Argumentation and Debate. 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.

Staff

SP 212 Interracial Communication. Preq: CI. 3(3-0) S. Focuses on human communication in interracial contexts. Stresses self awareness of racial attitudes and behaviors. Involves individual and group exercises and presentations. Requires one intensive weekend session.

Leonard, Locke

SP 213 Oral Interpretation of Literature. Preq: SP 110. 3(3-0) S. Develops skills in selection, preparation, and oral presentation of prose, drama, and poetry.

Franklin, Snow, Russell

SP 214 Introduction to Radio Production. 3(1-4) F. Basic principles and techniques of studio operation, performing, writing, and producing for radio.

Funkhouser

SP 215 Introduction to Speech Disorders. 3(3-0) F. A study of the development of normal speech and hearing. Common speech and hearing defects; basic techniques for their prevention and treatment.

Schumacher

SP 221 Traditional Theories of Rhetoric. 3(3-0) F. Examines the history of rhetorical theory from the Greek and Roman Periods through the beginnings of modern rhetorical theory in the early twentieth century. Emphasis on key concepts of rhetoric, their changes, and their use in various social structures.

Camp, Francesconi

SP 223 Play Production. 3(3-0) F,S. Introduction to the fundamentals of scenery design and set construction and practical applications with the use of design media and shop facilities. Participation in production activity for University Theatre presentations is required.

Janney

SP 224 Introduction to Television Production. 3(1-4) F. Principles of educational and commercial television. Examines role of television in society. Emphasis on producing, directing, and programming.

Funkhouser

SP 233 Introduction to Stage Lighting. 3(2-2) F. Introduces students to the fundamentals and uses of stage lighting equipment and stage lighting design. Provides for practical application of design media and shop facilities. Requires participation in production activity for University Theatre presentations.

Janney

SP 298 Special Projects in Speech-Communication. Preq: SP 110. 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.

Staff

SP 301 Advanced Public Speaking. Preqs: SP 110, SP 201. 3(3-0) F,S,Sum. An advanced study of public speaking. Emphasis upon mature application of theories of informative and persuasive oral discourse. Also covers ceremonial speaking. Critical analysis of student speeches by instructor and by class. Critical self-analysis by the student.

Parker, Camp, Francesconi

SP 302 Procedures for Meetings of Organizations. 3(3-0) F,Sum. Rules and customs of assemblies, including organization, motions; participation in and conduct of meetings; parliamentary strategy.

Camp

SP 303 Stage Directing. 3(3-0) F,S. Basic theory of directing and its application to theatrical production. Includes play reading, evaluation, casting procedure, staff organization, and rehearsal planning and practices.

Russell

SP 304 Survey of Broadcasting. 3(3-0) F. Examination of historical, legal, economic, and social aspects of broadcasting.

Funkhouser

SP 312 Barriers to Organizational Communication. 3(3-0). The organizational setting in which communication occurs, including the behavioral basis of the communicative act, with special reference to the roles of perception and motivation, and communication barriers.

Munn

SP 314 Advanced Radio Production. Preq: SP 214 or CL 3(1-4) S. Radio producing, directing, script-writing, and announcing. Involves production of interviews, documentaries, and sports programs for broadcast on regional radio stations.

Funkhouser

SP 315 Phonetics. 3(3-0) F,S. A study of the anatomy and movements of vocal organs, correct pronunciation; speech sounds; standards of American pronunciation; application of the International Phonetic Alphabet, with vocal and ear training.

Franklin, Parker

SP 322 Nonverbal Communication. Preq: SP 112. 3(3-0) F. A comprehensive study of theory and research in nonverbal communication, including: environment; space; physical appearance; movement; eyes and facial expressions; and vocal cues. Students will design and carry out individual and group research.

Leonard, Stone

SP 323 Introduction to Scenic Design. Preq: SP 223. 3(2-2) S. Introduces aesthetics of scenic design, elements and principles of design, theories and applications to the physical stage in relation to the script. Provides practical applications with the use of design media in University Theatre productions.

Janney

SP 324 Advanced Television Production. Preq: SP 224. 3(1-4) S. Television program production, including script writing, directing, staging, editing and the artistic/commercial aspects of television. Individual student projects include production of several videotapes for use on educational and commercial stations.

Funkhouser

SP 325 Anatomy and Physiology of Speech. Preq: SP 215; Coreq: SP 315. 3(3-0) F. Anatomy and Physiology of the speech mechanism with emphasis on respiration, phonation, resonance, articulation and the physical and acoustical aspects of the speech process.

Schumacher

SP 331 Traditional Rhetorical Criticism. Preq: SP 221. 3(3-0) S. Explores the practical uses of traditional rhetorical theory through the analysis and criticism of oral communication. Examines structures and strategies of addresses in social and historical settings. Speeches for study are selected each semester by the instructor.

Camp, Francesconi, Rodgers

SP 332 Communication in Interpersonal Relationships. Preq: SP 112. 3(3-0) S. A study of communication patterns in the development and deterioration of Interpersonal Relationships. Students will relate the theories to their own interpersonal relationships. Students will be involved in individual and group research and presentations.

Leonard, Stone

SP 335 Speech and Language Development. Preq: SP 215. 3(3-0) F. Alt. yrs. Theories of language development including prelinguistic, phonological, morphological development and acquisition of syntax. Behavioral development during infancy and early childhood. Course includes observations of normal children in a day care setting.

Schumacher

SP 345 Delayed Speech and Language Development. Preq: SP 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. Schumacher

SP 401 Contemporary Theories of Rhetoric. 3(3-0) S. Examines the extension of the concept of rhetoric and the multiplication of approaches to rhetorical theorizing in the twentieth century. Reviews non-Aristotelian theories, the philosophical orientation of semantics and neo-classical rhetorical theorists, and explores guidelines for future theory building. Camp, Francesconi, Rodgers

SP 411 Contemporary Rhetorical Criticism. Preq: SP 401. 3(3-0) F. Topics in the various styles and uses of public address in the modern world with emphasis on the critical applications of modern rhetorical theory. Examples of topics: the effects of mass media on communicator and audience, the rhetoric of confrontation and power maintenance, the use of persuasion in public relations, ethnic rhetoric. Camp, Francesconi, Rodgers

SP 412 Advanced Interpersonal Communication: Theories and Research. Preq: SP 112. 3(3-0) F. A comprehensive study of theories and research in Interpersonal Communication. Students design and carry out individual and group research. Leonard, Stone

SP 415 American Dialects. Preq: Basic knowledge of the International Phonetic Alphabet. 3(3-0) F,S,Sum. A comparative study of the major regional phonetic dialects of America in their cultural and geographic context. Special emphasis on North Carolina coastal, piedmont, and mountain speech patterns. Parker

SP 422 Interpersonal Communication: Laboratory. Preq: SP 412. Speech-Communication majors only. 3(0-6) S. Experience in dyadic and small group communication situations. Emphasizes application of theories previously studied in SP 412. Leonard, Stone

SP 425 Fundamentals of Diagnostic Procedures. Preqs: SP 215, 315, 335. 3(2-2) S. Alt. yrs. Principles, procedures, materials and instrumentation utilized in evaluating articulation, language, voice and fluency of children and adults. Includes clinical interviewing and report writing techniques. Schumacher

SP 490 Senior Seminar in Speech-Communication. Preq: Senior in Speech-Communication. 3(3-0) F,S. Research-oriented study of major periods, movements and personalities in oral communication. Encourages student to synthesize aspects of preceding work in speech. Staff

SP 498 Special Topics in Speech-Communication. Preq: Nine hours of speech. 1-6 F,S. Detailed investigation of topic in communication arts or sciences. Topic and mode of study determined by the faculty member in consultation with speech-communication head. Staff

SOIL SCIENCE

SSC 200 Soil Science. Preqs: CH 103 or 107; GY 120 recommended. 4(2-4) F,S. Fundamentals including origin, composition and classification of soils; their physical, chemical, and biological properties; significance of these properties to soil-plant relationships and soil management. For SSC students and those in allied fields. Cook, Robarge

SSC 205 Soils as a Natural Resource. Preq: CH 101 or 111. 3(2-3) F. Emphasis on soil as an important component in natural resource use and planning; characteristics and properties of soils as related to natural resources; impact of technological advances and soil use on environmental quality. Primarily for majors in fields not closely allied with SSC. Staff

SSC (BAE) 321 Water Management. Preq: Junior standing. 4(3-3) F. (See biological and agricultural engineering.)

SSC 341 Soil Fertility and Fertilizers. Preqs: SSC 200, BS 100. 3(3-0) F. Plant nutrition and growth as related to crop fertilization; fertilization materials, their manufacture, properties and usage; fertilizer practices for a sound management program. Kamprath

SSC 342 Soil Fertility Laboratory. Coreq: SSC 341. 1(0-3) F. Applications of soil fertility principles in plant growth; laboratory and greenhouse exercises in soil and plant tissue testing; written reports of observations and their interpretation. Nicholaidis

SSC 352 Soil Classification. Preq: SSC 200. 4(2-5) S. Morphology and diagnostic properties of soils; characterization of selected North Carolina soils and their placement in the modern soil classification system; practical field problem in soil identification and mapping. Field trips. Cook, Kleiss

SSC 361 Soil Resources and Land Use. Preq: SSC 200 or 205. 3(2-3) F. Factors important to the interpretation of soils information for land use with emphasis upon soil profile properties. Planning of land areas using soil maps; practical field problems in soils interpretation for various uses. King

SSC 461 Soil Physical Properties and Plant Growth. Preq: SSC 200 or equivalent. 3(3-0) F. Study of soil physical properties and their influence upon plant growth; emphasis placed on soil solid-porosity relationships, soil water, soil temperature, soil aeration and mechanical impedance. Principles associated with management and alteration of physical properties are also discussed. Cassel

SSC (CS) 462 Soil-Crop Management Systems. Preqs: CS 211, 414, SSC 341, 352. 3(2-3) S. Unites principles of soil science and crop science with those of allied areas into realistic agronomic applications; practical field studies in planning and evaluation of soil and crop management systems. Phillips, Fike

SSC (BAE) 471 Agricultural Water Management. Preqs: BS 100, SSC 200. 4(3-2) F. (See biological and agricultural engineering.)

SSC 472 Forest Soils. Preq: SSC 341, or FOR 452. 3(2-3) S. Soil as a medium for tree growth; the 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-tree orchards; the relation of soil and site to forest genetics, ecology, pathology, and entomology. Wollum

SSC 492 Senior Seminar in Soil Science. Preq: Senior standing. 1(1 0) S. Oral presentations by students on current topics in soil science; informal discussion of current topics among students and faculty. Cook

Selected 500-Level Courses Open To Advanced Undergraduates

SSC 501 Tropical Soils: Characteristics and Management. Preq: Six credits in SSC. 3(3-0) F. Characteristics of the tropical environment. Distribution and classification of tropical soils. Soil plant relationships in the tropics. Soil management systems emphasizing shifting cultivation, flooded rice production, subsistence farming and tropical pasture management. Sanchez

SSC 511 Soil Physics. Preqs: SSC 200, PY 212. 4(3-3) F. The study of soil physical properties and theory of selected instrumentation to measure them. Topics include soil solids, soil water, air and heat. Transport processes and the energy concept of soil and water are emphasized. Cassel

SSC 520 Soil and Plant Analysis. Preqs: PY 212; CH 315; at least three soils courses including SSC 341 or CI. 3(1-6) S. Theory and advanced principles of the utilization of chemical instruments to aid research on the heterogeneous systems of soils and plants. Gilliam

SSC 522 Soil Chemistry. Preqs: SSC 200, one year of general inorganic chemistry. 3(3-0) S. A consideration of the chemical and colloidal properties of clay and soil systems, including ion exchange and retention, soil solution reactions, solvation of clays and electrokinetic properties of clay-water systems. Weed

SSC (MB) 532 Soil Microbiology. Preqs: MB 401; CH 220 or CI. 4(3-3) S. Soil as a medium for microbial growth, the relation of microbes to important mineral transformations in soil, the importance of biological equilibrium, and significance of soil microbes to environmental quality. Wollum

SSC 541 Soil Fertility. Preq: SSC 341. 3(3-0) F. Soil conditions affecting plant growth and the chemistry of soil and fertilizer interrelationships. Factors affecting the availability of nutrients. Methods of measuring nutrient availability. Kamprath

SSC 551 Soil Morphology, Genesis and Classification. Preqs: GY 120, SSC 200, SSC 341. 3(3-0) F. Morphology: Concepts of soil horizons and soil profiles and chemical, physical and

mineralogical parameters useful in characterizing them. Genesis: Soil-forming factors and processes. Classification: Historical development and present concepts of soil taxonomy with particular reference to great soil groups as well as discussion of logical basis of soil classification. Buol

SSC 553 Soil Mineralogy. Preqs: SSC 200, SSC 3+1. 3Y 330. 3(2-3) F. Composition, structure, classification, identification, origin, occurrence, and significance of soil minerals with emphasis on primary weatherable silicates, layer silicate clays, and sesquioxides. Weed

SSC 560 Advanced Soil Management. Preqs: SSC 200, 341. 3(3-0) Sum. Studies of soil characteristics in the coastal plain, piedmont and mountain areas of North Carolina including several field trips. Discussion of management practices that should be associated with various soils for different types of enterprises. (Offered Sum. 1979 and alt. years.) Cook, Kamprath, Phillips

SSC 590 Special Problems. Preq: SSC 200. Credit Arranged. F.S. Special problems in various phases of soils. Emphasis will be placed on review of recent and current research. Graduate Staff

STATISTICS

ST 311 Introduction to Statistics. 3(3-0) F,S,Sum. Relates general statistical concepts to everyday life and emphasizes giving perspective to those concepts: quantitative descriptions of populations, some sampling ideas, techniques of making inferences from samples, and the uncertainties involved in making statistical inferences. Hafley, McVay, Stines

ST (EB) 350 Economics and Business Statistics. Preqs: MA 113, EB 201 and 202 or equivalent. 3(3-0) F,S. (See economics and business.)

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. Staff

ST 371 Introduction to Probability and Distribution Theory. Preq: MA 201. 2(1-2) F,S,Sum. Basic concepts of probability and distribution theory for students in the physical sciences and engineering. Intended to provide the background necessary to begin the study of statistical inference and regression analysis. Manson, Quesenberry

ST 372 Introduction to Statistical Inference and Regression. Preq: ST 371. 2(1-2) 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 , x - and F . Simple linear regression and correlation. Introduction to multiple regression. Manson, Quesenberry

ST 421, 422 Introduction to Mathematical Statistics. (421) Preq: MA 202 or 212; (422) Preq: ST 421. 3(3-0) F,S. Elementary mathematical statistics primarily for undergraduate majors and graduate minors in statistics. Includes introduction to probability, common theoretical distributions, moments, moment generating functions, sampling distributions, estimation, hypothesis testing concepts, decision theory concepts and elements of general linear model theory. Staff

ST 493 Special Topics in Statistics. Preq: CL 1-3 F,S,Sum. Directed readings, problem sets, written and oral reports as indicated by need and interest of student. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

ST 501, 502 Basic Statistical Analysis. Preq: ST 372 or equivalent or CL 3(3-0) F,S. Basic concepts, random variables, distributions, statistical measures, estimation, tests of hypotheses, the anova, elementary design and sampling, factorial experiments, multiple regression, covariance, analysis of discrete data and other topics. Primarily for statistics majors and minors. Steel

- ST 507 Statistics for the Behavioral Sciences I.** 3(3-0) F. A general introduction to the use of descriptive and inferential statistics in behavioral science research. Methods for describing and summarizing data are presented, followed by procedures for estimating population parameters and testing hypotheses concerning the summarized data. Wasik
- ST 508 Statistics for the Behavioral Sciences II.** Preq: ST 507 or CI. 3(3-0) S. The use of statistical design principles in behavioral science research is introduced. The use of a statistical model to represent the structure of data collected from a designed experiment or survey study is presented. Opportunities are provided for use of a computer to perform analyses of data to evaluate the proposed statistical model and to assist in post-hoc analysis procedures. Least squares principles are used to integrate the topics of multiple linear regression analysis, the analysis of variance, and analysis of covariance. Wasik
- ST 511 Experimental Statistics for Biological Sciences I.** Preq: ST 311 or grad. standing. 3(3-0) F.S. Basic concepts of statistical models and use of samples; variation, statistical measures, distributions, tests of significance, analysis of variance and elementary experimental design, regression and correlation, chi-square. Graduate Staff
- ST 512 Experimental Statistics for Biological Sciences II.** Preq: ST 511 or equivalent. 3(3-0) F.S. Covariance, multiple regression, curvilinear regression, concepts of experimental design, factorial experiments, confounded factorials, individual degrees of freedom and split-plot designs. Graduate Staff
- ST 513 Experimental Statistics for Social Sciences I.** Preq: ST 311 or grad. standing. 3(3-0) F. Basic ideas of statistical inference; probability distributions, hypothesis testing, estimation, with emphasis on applications to sample data from experiments and surveys. McVay
- ST 514 Experimental Statistics for Social Sciences II.** Preq: ST 513 or equivalent. 3(3-0) S. Extension of basic statistical concepts to computer handling of data from social surveys; sample designs using clustered, stratified, systematic and multi-stage selections; analysis of variance continued; multiple, multivariate regression. Proctor
- ST 515, 516 Experimental Statistics for Engineers.** Preq: ST 361 or grad. standing. 3(3-0) F.S. General statistical concepts and techniques useful to research workers in engineering, textiles, wood technology, etc. Probability distributions, measurement of precision, simple and multiple regression, tests of significance, analysis of variance, enumeration data, and experimental designs. Hader
- ST 517 Applied Least Squares.** Preq: ST 502 or equivalent. 3(3-0) F. Least squares estimation and hypothesis testing procedures for linear models. Regression, analysis of variance and covariance is considered in a unified manner that requires no extensive mathematical background. Emphasis is on the use of the computer to apply these techniques to experimental (including unequal cell sizes) and survey situations. Wasik
- ST 519 Applied Multivariate Statistical Analysis.** Preqs: ST 511 and ST 512 or equivalent. 3(3-0) S. An introduction to the use of multivariate statistical methods in the analysis of data collected in experiments and surveys. Topics covered will include multivariate analysis of variance, discriminant analysis, canonical correlation analysis and principal components analysis. The use of a computer to perform the multivariate statistical analysis calculations will be emphasized. Wasik, Gerig
- ST 521 Statistical Theory I.** Coreqs: MA 425 or MA 405 or CI. 3(2-2) F. Discussion of the use of statistics as illustrated by an example pointing out the need for a probabilistic framework. The probability tools for statistics: description of discrete and absolutely continuous distributions, expected values, moments, moment generating functions, transformation of random variables, marginal and conditional distributions, independence, order statistics, multivariate distributions, concept of random sample, derivation of many sampling distributions. Grandage, Bhattacharyya
- ST 522 Statistical Theory II.** Preq: ST 521; Coreq: MA 426 or 512. 3(2 2) S. General framework for statistical inference. Point estimators: biased and unbiased, minimum variance unbiased, least mean square error, maximum likelihood and least squares, asymptotic properties. Interval estimators and tests of hypotheses: confidence intervals,

power functions, Neyman-Pearson lemma, likelihood ratio tests, unbiasedness, efficiency and sufficiency.

Grandage, Bhattacharyya

ST 531 Design of Experiments. Preq: ST 502 or equivalent. 3(3-0) F. Review of completely randomized, randomized complete block and Latin square designs, and the basic concepts in the techniques of experimental design. Designs and analysis methods in factorial experiments, confounded factorials, response surface methodology, change-over design, split-plot experiments and incomplete block designs. Examples will be used to illustrate application and analysis of these designs.

Monroe

ST 532 Introduction to Survey Sampling. Preq: MA 214 or ST 311 or equivalent. 3(3-0) S. Description of the principal steps in the planning and execution of sample surveys. Review of actual surveys in various fields. Basic concepts of sampling and sampling methods. Practice in evaluating and designing sample surveys.

Proctor, Graduate Staff

ST (MA) 541 Theory of Probability I. 3(3-0) F. (See mathematics.)

ST (MA) 542 Introduction to Stochastic Processes. Preqs: MA 405 and MA 541 or ST 521. 3(3-0) S. Markov chains and Markov processes, Poisson process, birth and death processes, queuing theory, renewal theory, stationary processes, Brownian motion.

Wesler, Bhattacharyya

ST 552 Basic Theory of Least Squares and Variance Components. Preqs: MA 405, ST 521; Coreq: ST 522. 3(2-2) S. Theory of least squares; multiple regression; analysis of variance and covariance; experimental design models; factorial experiments; variance component models.

Gallant

ST (EB) 561 Intermediate Econometrics. 3(3-0) S. (See economics and business.)

ST (BMA, MA) 571 Biomathematics I. 3(3-0) F. (See biomathematics.)

ST (BMA, MA) 572 Biomathematics II. 3(3-0) S. (See biomathematics.)

ST 581 Introduction to Nonparametric Statistics. Preq: ST 522. 3(3-0) F. This course will treat both theoretical and methodological material relevant to inference problems arising when sampling is from a parent family with distribution function that is not assumed to have a particular functional form. Most of the course will be devoted to inference problems for the absolutely continuous family of distributions.

Boos

ST 583 Introduction to Statistical Decision Theory. Preq: ST 522. 3(3-0) F. Zero sum two person game and statistical inference. Bayesian methods and orthodox statistical estimation and testing; minimax decision rule; empirical Bayes procedure; Bayes sequential decision procedure. (Offered F 1979 and alt. years.)

Bhattacharyya

ST 591 Special Problems. 1-3 F.S. Development of techniques for specialized cases, particularly in connection with thesis and practical consulting problems.

Graduate Staff

SOCIAL WORK

SW 203 Social Welfare in the United States. 3(3-0) F,S,Sum. Introduction to current social welfare programs in the United States. Examines historical development of these programs including the motivations of individuals and groups which initiated them. Students visit selected programs and explore their philosophies, structures and effectiveness.

SW 205 Social Welfare Policies and Issues. Preq: SW 203. 3(3-0) F,S,Sum. Examines policies and issues associated with existing social welfare delivery systems and emphasizes policy formulation and assessment of alternative strategies for establishing and meeting social goals. Influence of social work principles, values and practice on social welfare policies and issues.

SW 307 Social Welfare Programs and Delivery Systems. Preq: SW 205. 3(3-0) F,S,Sum. An in-depth study of major social welfare programs. Focus is on income maintenance programs and social services provided to the aged, families and children, handicapped adults and minority groups. Program content and methods of service delivery explored in class and by small student teams to determine effectiveness of financial and non-financial programs.

SW 308 Social Work Practice and Methods I. Preq: SW 307. 3(3-0) F,S. Fundamental elements of an integrated approach to social work practice. Focuses on professional values, social work roles and the social work-client relationships. Skills in interviewing, data collection and case recording are explored and practiced.

SW 310 Personality Development and Human Behavior. Preq: Sophomore standing. 3(3-0) F,S,Sum. Knowledge of man as an individual, interacting with an ever-changing social environment, continually evolving as a unique personality with individualistic combination of capacities and mechanisms for coping.

SW 312 Social Work Practice in Health Care. For Social Work students. 3(3-0) F,S,Sum. Focus on essential practice skills and knowledge required of social workers in health care systems. Study of multi-disciplinary team work in health care. An examination of the social components of major illnesses and disabilities, including prevention and rehabilitation. Discussion of emotional, cultural, economic and social factors in health and illness. Identification of health needs of specific population groups. Goldstein

SW 405 Social Work Practice and Methods II. Preq: SW 308. 3(3-0) F,S. Examines the strategies of study, evaluation and intervention utilized in social work practice in the beginning, core and ending phases of the social worker-client, problem solving relationship.

SW 406 Field Work I. Preq: or Coreq: SW 405. 6(2-16) F,S,Sum. Supervised field experience in a social welfare agency or program for two full days each week. Assigned participation in an agency or program operation includes interaction with individuals, small groups, and agency staff. Provision for application of social work values, skills, objectives and methods gained in class. A two hour seminar on campus each week will link social work theory with field experience.

SW 407 Field Work II. Preq: SW 406. 6(2-16) F,S,Sum. Supervised field experience in a social welfare agency or program for two days each week and a two hour weekly seminar enables the student to increase and refine professional social work skills and knowledge. Seminars focus on integration of content areas of the curriculum with field practice. Faculty liaison with field instructors and students on a regular basis.

SW 420 The Legal Aspects of Social Work. Preq: SW 307. Social Work students only. 3(3-0) F,S. This course explores the roles of the Social Worker in the legal field. Legal terms and procedures and the state and federal courts systems are studied. The legal aspects of protective services for children and adults, the child support laws and the juvenile justice system are examined. Students receive experience in locating and using legal records.

SW 498 Special Topics in Social Work. Preq: Nine hours of Social Work. Social Work students only. 3(3-0) F,S. Independent or small group study of a Social Work practice or social welfare area. Topic and mode of study is determined by the faculty member. This course may occasionally be used to test new course content in specific social welfare areas such as child welfare, income maintenance or aging. Staff

TEXTILES

T 101 Textile Concepts. Available only to first semester freshmen in Textiles. 1(0-2) F. An introduction to textiles including the terminology and history of the industry; the physical and chemical processes involved in producing textile products from raw materials; the unique aesthetic, physical and chemical properties of textiles; and the utilization of textiles. Staff

T 200 Introduction to Textiles. Not open to students required to take T 101. 3(3-0) F,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. Staff

T 203 Introduction to Polymer Chemistry. Preq: CH 101. 3(3-0) F,S,Sum. Lectures emphasize: chemical constitution and properties of fiber-forming polymers; theories of fiber

structure; relationship between the molecular structure of linear polymers and physical properties of natural and man-made fibers; principles and methods for producing man-made fibers; chemical behavior of natural and man-made fibers. Staff

T 211 Introduction to Fiber Science. Preq: MA 112 or 102. 3(2-2) F,S,Sum. The physical properties of textile raw materials are related to type of fibers and chemical structure. Typical areas are parameters used to describe textile fibers, classification in terms of quality factors, their reactions to moisture, stress-strain properties, method of measuring physical properties covered in Introduction to Polymer Chemistry and relationship between polymer structure, fiber properties, and their utilization as single fiber composites or blends of fibers. Staff

T 220 Yarn Forming Systems. Preq: T 101 or equivalent. 4(3-2) F,S,Sum. The principles of staple and filament yarn systems and structures. The influence of manufacturing systems and the input materials on product characteristics. Staff

T 250 Fabric Forming Systems. Preq: MA 111 or equivalent. 3(3-0) F,S,Sum. The course deals with the basic forming systems including weaving, knitting and nonconventional. Fundamentals of conversion of fibers and yarns into fabrics. Fabric design, construction and raw materials are considered related to properties and performance of the end product. Staff

T 301 Technology of Dyeing and Finishing. Preq: T 203. 4(3-2) F,S,Sum. A comprehensive course designed to familiarize the textile student with the basic principles involved and the procedures used for the preparation, dyeing, printing, and finishing of natural and man-made fibers. Some emphasis is placed upon the chemical nature of dyes and fastness properties, and the chemical nature of finishes used to impart specific end-use properties. Staff

T 305 Introduction to Color Science. Preq: Soph. standing in textiles or equivalent. 1(1-0) S. Discussion of color vision, defective color vision as it contributes to the understanding of color vision. Definition of color space and detailed discussion of the measurements and transformation of coordinates leading to the "CIE" color space. Color calculations, differences and matching. McGregor

T 401 Environmental Aspects of the Textile Industry. Preq: Senior standing. 3(3-0) S. Introduction to general 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 of successful solutions. Management techniques for pollution control by waste reduction, treatment, and effluent control. Safety and health management for hazards in the industry. Emerson

T 402 Introduction to the Theory and Practice of Fiber Formation. Preqs: CH 103, T 203, MA 212, PY 212. 3(3-0) S. Fundamental theory of flow behavior of polymeric materials as related to the formation of fibers by melt, dry and wet extrusion is discussed. Elementary theories of drawing and heat setting are also analyzed. This background is then applied to interpret the entire fiber forming processes of representative all-synthetic and cellulose fibers. Cuculo

T (PD) 471 Introduction to Textile Design I. 3(2-2) S. (See product design.)

T (PD) 472 Textile Design II/Internship. Preq: PD (T) 471, 3 Sum. (See product design.)

T (PD) 473 Textile Design III. Preqs: PD (T) 471, 472. 3(2-2) F. (See product design.)

T 491H Honors Seminar in Textiles. By invitation into Honors Program in Textiles. 1(1-0) F,S. A seminar on various topics in the fields of Textiles and Fiber and Polymer Science. Staff

T 493 Industrial Internship in Textiles. Preq: Jr. or sr. in good standing. 3-6 Sum. A professional level work experience in any area of textiles designed to relate academic training in science and technology to industrial practice. Work experience under professional guidance. Written reports required and used as basis for grading. Registration must be approved in advance by the appropriate department head. Graded S or U. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

T 500 Advanced Microscopy. Preq: CL. 3(1-4) F,S. Art and science of light and electron microscopy. Introduction to microradiography; theoretical and practical aspects of visibility,

resolution and contrast. Assembly, testing and use of microscopes and accessories in describing, identifying and micrographing crystalline oriented or amorphous materials, especially those of interest to the student. May include special projects for independent investigations.

Tucker

T 501 Resinography. Preqs: T 500 and TX 460 or TC 461. 3(1-4) F,S. Structure and morphology of resins, fibers, elastomers and composites, studied by reflected and transmitted light or electrons. Other methods of diffraction and spectrometry. Crystallographic and optical properties emphasized.

Graduate Staff

T 506 Color Science. Preq: Sr. in TC or grad. standing. 3(2-2) F. A thorough discussion of color theory with particular emphasis on color measurement. Color and color difference calculations. From the data of the basic color matching experiments the description of a color space and its transformation into the CIE color space will be followed in detail. The basis of color difference calculations will be discussed. Color matches and color differences will be calculated based on experimental data obtained in the course.

McGregor

TEXTILE CHEMISTRY

TC 303 Textile Chemistry I. Preq: Soph. standing or equivalent. 2(2-0) S. The physical and chemical phenomena which occur in the preparation and finishing of textile materials. Emphasis on general principles, rather than detailed technical procedures.

McGregor

TC 403, 404 Textile Chemical Technology. (403) Preqs: T 301, TC 303; Coreq: CH 223; (404) Preq: TC 403. 3(3-0) F,S. The chemistry involved in the wet processing of fibrous systems, especially dyeing, printing and finishing. Emphasizes principles and includes a study of the various classes of dyes and their application to all important textile fibers and blends of fibers; preparatory and bleaching processes, roller printing and print formulations for important dye classes; nature and application of finishes for textiles.

Livengood

TC 405, 406 Textile Chemical Technology Laboratory. (405) Preqs: T 301, TC 303; Coreq: TC 403. 1(0-3) F. (406) Preqs: CH 223, TC 303; Coreq: TC 404. 2(0-6) S. Designed to complement the subject matter of TC 403, 404 by selected laboratory and pilot plant exercises in the application of selected important dyes and finishes to the important fiber types.

Livengood

TC 412 Textile Chemical Analysis II. Preq: T 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.

Cates

TC 415 Textile Printing. Preq: T 301. Junior standing. 3(2-2) F. A systematic introduction to the technological aspects of the techniques used in commercial fabric printing, as a basis for the informed design of printed fabrics. Stress is placed on the inter-relationships among pattern design, consumer end-use and limitations or requirements of the different machines and procedures in current practice. The laboratory activities in this course include original design project work.

Guion

TC (CH) 461 Introduction to Fiber-Forming Polymers. Preq: CH 223. 3(3-0) F. Lectures emphasize: the formation and properties of fiber-forming polymers; addition and condensation polymerization; theories of fiber structure, the relationship between the chemical structure and physical properties of natural and man-made fibers; the production of man-made fibers.

Gilbert

TC 490 Special Topics in Textile Chemistry. 1-6 F,S. Topics relate to current developments in textile and polymer chemistry.

Staff

TC 491 Seminar in Textile Chemistry. Preq: TC 403. 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.

Staff

Selected 500-Level Courses Open To Advanced Undergraduates

TC 504 Fiber Formation Theory and Practice. Preqs: MA 301, PY 208 or CI. 3(3-0) F. Practical and theoretical analysis of the chemical and physical principles underlying the conventional methods of converting bulk polymer to fiber; rheology; melt, dry and wet polymer extrusion; fiber drawing; heat setting; general theory applied to unit processes. Cuculo

TC 505 Theory of Dyeing. Preq: CH 433 or CI. 3(3-0) S. Mechanisms of dyeing. Application of thermodynamics to dyeing systems. Kinetics of diffusion in dyeing processes. McGregor

TC 561 Organic Chemistry of High Polymers. Preqs: TC (CH) 461, CH 331 or CH 431. 3(3-0) S. Principles of step- and chain-growth polymerizations; copolymerization theory; homogeneous free radical polymerization; emulsion polymerization; Ziegler-Natta polymerization; ionic polymerization. Gilbert, Theil

TC (CH) 562 Physical Chemistry of High Polymers—Bulk Properties. Preqs: CH 220 or 223, CH 331 or 431. 3(3-0) F. Molecular weight; states of aggregation and their interconversion; rubbery, glassy and crystalline states; rubber elasticity; molecular friction; diffusion and viscosity; dynamics of network response; retardation- and relaxation-time spectra; thermodynamics of nucleation; kinetics of crystallization. Cates, Walsh

TC (CHE) 569 Polymers, Surfactants and Colloidal Materials. 3(3-0) F. (See chemical engineering.)

TC (CHE) 570 Radiation Chemistry and Technology of Polymeric Systems. 3(3-0) S. (See chemical engineering.)

TC 591 Special Topics in Textile Science. Preqs: Sr. or grad. standing and CL 1-4 F.S. Intensive treatments of selected topics in textile, polymer and fiber science. Graduate Staff

TOXICOLOGY

Selected 500-Level Courses Open To Advanced Undergraduates

TOX 510 Biochemical Toxicology. Preqs: Biochemistry, sr. standing. 3(3-0) F. Emphasis is placed on the molecular events that occur during the toxic action of xenobiotics, including penetration phenomena, mechanisms involved in detoxication, and the mechanisms of action at the target site.

TOX 515 Environmental Toxicology. Preq: Two years of biology. 3(3-0) S. The nature, distribution and significance of microchemical contamination will be evaluated. Emphasis will be placed on current, relevant problems.

TEXTILE MATERIALS AND MANAGEMENT

TX 305 Direct Fiber to Fabric Production. Preqs: T 203, PY 211 or 205; Coreq: ST 361, PY 212 or 208. 2(1-2) F,S. An intermediate course providing the basis for understanding modern fabrics which are produced directly from fibers. The physical and chemical nature of local bonding and fiber entanglement will be emphasized. Viable processes for the production of these classes of fabrics are discussed together with the economic justification for process and production. George, Mohamed

TX 320 Mechanics of Spun Yarn Manufacturing Systems. Preq: T 220; Coreq: T 211. 4(3-2) F,S,Sum. A study of machine-fiber interactions in spun yarn manufacturing processes such as: blending, drafting, spinning and packaging. The course will also analyze factors affecting production rate and quality requirement. Staff

TX 330 Textile Measurements and Quality Control. Preqs: T 250, ST 361. 4(3-2) F,S,Sum. Principles of measuring basic physical properties of textile materials, techniques of in-process control and evaluation of finished product quality, application to the manufacturing sequence of statistical control charts and capability limits, aspects of sampling theory. Staff

TX 341 Knitting Systems. Preq: T 250. 3(2-2) F,S,Sum. Technology of producing knitted fabrics. The range of fabric structures is reviewed, but the major emphasis is on yarn preparation for knitting, the basic mechanics of weft and warp knitting machines, patterning mechanisms, technologies of production, new developments and management of knitting operations. Staff

TX 351 Weaving Systems. Preq: T 250. 3(2-2) F,S,Sum. Technology of producing woven fabrics. The range of fabric structures is reviewed but the major emphasis is on yarn preparation for weaving, the basic mechanics of looms, the technologies of production, new developments and management of weaving operations. Staff

TX 370 Technical Fabric Design. Preqs: TX 341 and TX 351. 4(3-2) F,S. Technical aspects of textile fabric design. Available technologies are reviewed; properties of the various types of fabric, methods of reproducing aesthetic designs and means of designing fabrics to specifications are covered. Lab consists of formal designs, analyses, testing and design projects. Staff

TX 380 Management and Control of Textile Systems. Preqs: EB 201, T 250. 3(3-0) F,S. The principles and techniques of controlling the process of converting staple fibers or filament yarns into industrial and consumer products as viewed from the standpoint of the process decision maker. Staff

TX 381 Supervision in the Textile Industries. Preqs: TX 380, PSY 200. 3(3-0) F,S. A specialized study of supervision as applied to the specific problems confronting the textile industry. Emphasis is placed upon the role of supervisors in maintaining productivity in an atmosphere wherein continuing and critical problems prevail. Competencies needed in supervisors in order to effectively discharge their responsibilities are emphasized. Robinson

TX 405 Non-Conventional Fabric Structures. Preq: Sr. standing and CL 3(3-0) S. Advanced study of systems for direct conversion of fiber to fabrics. The total spectrum of possible fabric structure is surveyed and classified. Current marketable structures analyzed with respect to production technologic, economic, and property potential. Trends in direct conversion technology are discussed to provide a viable basis for participating in the evolution of the technology and its production. George, Mohamed

TX 420 Modern Developments in Yarn Manufacturing Systems. Preq: Sr. standing. 3(3-0) S. The newly emerging means of yarn production such as open-end, composite, self-twist and twistless forms of spinning. The pre-processes and their effects on spinning; also the after-processes and effects of the new systems. Grady, Lord

TX 425 Textured Yarn Production and Properties. Preqs: T 211, T 220. 3(2-2) F,S. The structure of thermoplastic polymers in continuous filament form and their response to elevated temperatures, high velocity air flow and other methods of modification to produce bulked, textured and torque type yarns. Related properties such as stress relaxation, generation and control of electrostatic changes and responses to lower order tensile forces. El Shiekh, Tucker

TX 426 Long Staple and Tow Systems. Preqs: T 211, T 220. 3(2-2) F,S. Long staple yarn forming systems including the woolen, worsted, tow to top, and compact yarn systems. Emphasis on relationship of fiber structures and characteristics necessary to produce the desired properties and performance characteristics of such yarns as woolen and worsted blends with man-made fibers, bulked yarns and carpet yarns. Staff

TX 431 Special Topics in Testing. Preq: TX 330, sr. or grad. standing. 3(2-2) S. Special advanced techniques for measuring selected physical and aesthetic properties of natural and man-made textile materials; application of the physical law to technique and instrumentation; interrelation of the material, method of test, instrumentation involved and the resulting physical measure. Stuckey

TX 441 Knitwear and Hosiery Manufacture. Preq: TX 370. 3(2-2) F. Complex weft knit mechanisms and their products. Hosiery, sweater strip, and full-fashioned equipment and products discussed with respect to quality, costing, and recent developments. Middleton

TX 442 Advanced Knitted Fabric Design. Preq: TX 370. 3(2-2) S. Complex warp- and weft-knitted structures, including flat, solid or open-work, plain or jacquard structures,

raised and relief effects and other three-dimensional cloths, such as plush, fleece, and sliver fabrics. Technology of fabric processing, design potential and limitations, fabric aesthetics and markets. Practical fabric manufacture and analysis. Knapton, Rhodes

TX 443 Analysis of Knitting Systems and Fabric Properties. Preq: TX 341. 3(3-0) F. Studies of the mechanisms of loop formation on warp- and weft-knitting machinery, including yarn tension analysis and robbing-back theory. Simple mechanical and textile force analyses of linear cam systems, and their relationship to practical fabric knittability. Basic fabric geometry and the analysis of knitted fabric dimensional and mechanical properties. Knapton

TX 449 Warp Knitting Systems. Preq: TX 370. 3(2-2) S. Critical review and discussion of production of warp knitted fabric principles. Aspects of warp knitting including yarns, machinery and methods of operation analyzed and discussed both individually and as a part of the total system. Fabric design, quality and costing. Staff

TX 450 Advanced Weaving. Preq: TX 351. 3(2-2) F. Alt. yrs. New developments in weaving machinery, weaving of specialty fabrics and organization of weaving operations. Mohamed

TX 451 Advanced Woven Fabric Design. Preq: TX 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

TX 460 Physical Properties of Textile Fibers. Preqs: MA 212, PY 212. 3(3-0) F.S. The structural, mechanical, thermal, optical, frictional and electrical properties, and the effect of moisture on physical and mechanical properties. Influence of these properties on utility and scope of fibers as related to performance. Staff

TX 470 Fabric Styling and Design. Preqs: Jr. or sr. standing and CI. 2(2-0) F.S. Basic textile styling and design as influenced by aesthetic and end-use considerations. Limitations and influence of current technology on design principles and aesthetic capabilities. Massey

TX 480 Textile Cost Control. Preqs: EB 201, one yarn and one fabric course at 300 level or better. 3(3-0) F.S. Cost methods applicable to textile costing with emphasis on decision-making. Interpretation of cost reports and their use in pricing and cost control. Staff

TX (EB) 482 Sales Management for Textiles. Preq: TX 380. 3(3-0) F.S. Definition and analysis of sales management in the textile industry. Areas of control and responsibility. Analytical tools of sales management with case methods. Staff

TX 484 Management Decision Making for the Textile Firm. Preq: TX (EB) 482. 3(3-0) F.S. The economic and environmental setting within which the textile firm makes decisions, and an application of various analytical tools, quantitative and qualitative, in making these decisions. Strategies for implementing decisions. Dyer

TX 487 Textile Labor Management. Preq: Sr. standing. 3(3-0) F.S. Labor management problems in the textile industry, with emphasis directed toward role of production supervision in a non-union textile plant. A study of NLRB decisions and court opinions involving textile corporations. Powell

TX 490 Development Project in Textile Technology. Preq: Sr. standing and 2.75 GPA. Course may be taken twice provided projects are different subject matter. 2-3 F.S., Sum. Introduction to research through experimental, theoretical and literature studies of textile and related problems. Staff

TX 491 Special Topics in Textiles. Preq: Sr. standing. 1-3 F.S. Special topics related to current developments in the textile industry. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

TX 505 Textile Instrumentation and Control Systems. Preqs: MA 301, PY 212 and one course in computer science. 3(3-0) F. The theory and application of instruments and control systems used in modern textile plants. Basic instruments and computer systems are described along with their use in process control, production control, research and development. Graduate Staff

- TX 520 Yarn Processing Dynamics.** Preqs: MA 301 and CI or grad. standing. 3(2-2) F. Theoretical analysis of the dynamics and machine-fiber interactions of such functions as opening, cleaning, carding actions, fiber attenuation, ring spinning, open-end spinning, texturing and winding. The role of fiber placement, cohesion and lubrication on yarn processing and properties. Laboratory experiments are designed to verify the analysis discussed in the lectures. Lord, El-Shiekh
- TX 530 Textile Quality Control.** Preq: TX 330 or CI. 3(3-0) S. Quality control systems for textile operations with emphasis on sampling plans for attributes and variables and on interpretation of data as related to identifying sources of product variability. Stuckey
- TX 541 Theory and Practice of Knitted Fabric Production and Control.** Preqs: TX 370 and CI. 3(3-0) F. The technology and control of systems for manufacturing simple and complex knitted fabrics; control and monitoring of yarn feeding systems; influence of yarn, machine, finishing and fabric structure on the fabric aesthetics, physical and mechanical properties; optimization of fabric properties and machine productivity, including costing; problems of jacquard fabric processing and control. Knapton
- TX 549 Warp Knit Engineering and Structural Design.** Preq: TX 449. 3(3-0) S. Engineering analysis of tricot and raschel machinery. Design of yarn let-off and fabric take-up mechanisms. Studies of fabric production techniques and quality control systems. Theory of production optimization and the properties of fabrics. Complex geometrical loop models and their application. Knapton
- TX 555 Production Mechanics and Properties of Woven Fabrics.** Preqs: MA 301 and CI or grad. standing. 3(2-2) S. The interrelations between the mechanics of production and mechanical properties of woven fabrics; unit operations required to prepare yarns for weaving and the mechanisms employed in weaving; fabric structure, geometry and mechanical properties; designing for specific fabric properties. Mohamed
- TX 561 Mechanical and Rheological Properties of Fibrous Material.** Preq: MA 301. 3(2-2) S. In-depth study of the stress-strain, bending, torsional, dynamic and rheological behavior of natural and man-made fibers. Theoretical relations and advanced techniques are presented and discussed. Fornes, Gupta
- TX 562 Physical Properties of Fiber Forming, Fibers and Fibrous Structures.** Preqs: MA 301, PY 208. 3(3-0) F. Experimental results and theoretical considerations of the physical properties of fibers and fiber forming polymers will be discussed. This will include electrical, thermal, optical, frictional and moisture properties of these materials. The influence of chemical and molecular fine structure on these properties will be discussed. Gupta, Fornes
- TX 563 Characterization of Structure of Fiber Forming Polymers.** Preqs: MA 301, PY 208. 3(3-0) F. Theories, experimental evidence and characterization methods of the molecular fine structure of fiber forming polymers in the solid state will be discussed. Characterization methods will include X-ray diffraction, microscopy, infrared, thermal, and magnetic resonance. An introduction to nucleation theory of polymer systems will be presented. Gupta, Fornes
- TX (EB) 585 Market Research in Textiles.** Preqs: MA 405, ST 421. 3(3-0) S. A study and analysis of the quantitative methods employed in market research in the textile industry. The function of market research and its proper orientation to management and decision-making. Dyer
- TX 590 Special Projects in Textiles.** Preqs: Sr. standing or grad. standing, CI. 2-3 F,S,Sum. Special studies in either the major or minor field of the advanced undergraduate or graduate student. These studies will include current problems of the industry, independent investigations, seminars and technical presentations, both oral and written. Graduate Staff
- TX 591 Special Topics.** Preq: CI. 1-4 F,S. An intensive treatment of selected topics involving textile technology. Graduate Staff
- TX 598 Textile Technology Seminar.** Preqs: Sr. standing, CI. 2(2-0) S. Lecture and discussion of current topics relating to the textile industry. Graduate Staff

URBAN DESIGN

Selected 500-Level Courses Open To Advanced Undergraduates

UD 510 Theory of Urban Form. Preq: Grad. standing or advanced undergrad. standing. 3(3-0) S. Survey of interdisciplinary theory of urban growth and evolution with about one-half of the class periods devoted to historical development of theory, and the other half devoted to contemporary quantitative models of urban form.

UD 530 Programming and Design Criteria for Community Development. Preq: Advanced undergrad. or grad. standing, or CI. 3(2-1) F,S. This course is designed to reveal the programmatic requirements of communities in terms of density, size, physical structure and evolutionary characteristics of urban populations, and provides the designer and planner with estimates of the projected demand for facilities and services.

UD 590 Special Topics in Urban Design I. Preq: Fourth year standing. 1-6 F,S. This course provides a flexible means for investigation into areas of special interest related to urban design. It is intended primarily to encourage independent study and research.

UNIVERSITY STUDIES

UNI 295 Special Topics in University Studies. 1-6 F,S. Detailed investigation of an interdisciplinary topic (or topics). Topic, mode of study, and design of study to be determined by faculty member(s) and/or teaching team in consultation with the Division of University Studies Curriculum Committee and with the approval of the Division Head.

UNI 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.

UNI 302 Contemporary Science and Human Values. Preq: Soph. standing. 3(3-0) F,S. Surveys of some of the revolutionary developments in 20th century science and scientific method, particularly in the bio-sciences and psycho-social sciences, and explores their major intellectual consequences.

UNI 303 Man and His Environment. Preq: Soph. standing. 3(3-0) F,S. Attention is directed to the fundamental concepts of ecology, the impacts of technology upon the contemporary world environment, the broad, humanistic aspects of our present environmental problems and the need for new institutional arrangements in both government and the university as an aid to their solution.

UNI 323 World Population and Food Prospects. Preq: Soph. standing. 3(3-0) S. An interdisciplinary analysis of United States and world population growth in connection with national and world food requirements and man's place in the ecology of the earth. Controversial proposals discussed and evaluated.

UNI 324 Alternative Futures. 3(3-0) F. An examination of possible alternative future societies with stress upon the nature and likelihood of various alternatives. Special emphasis is given to the methodology and limitations of forecasting and the interaction between present and possible future technologies and human values.

UNI 325 Bio-Medical Ethics: An Interdisciplinary Inquiry. 3(3-0) F,S. An interdisciplinary examination and appraisal of emerging ethical and social issues that are the result of recent advances in the bio-medical sciences. Topics will include genetic engineering, abortion, euthanasia, consent, behavior control, death, pre-natal diagnosis and bio-medical experimentation. Attention will focus on factual details, value questions, the interplay of "fact" and "value," assessment of impact and questions of policy formulation.

UNI 326 Technology Assessment. 3(3-0) S. Methodological analysis of the desirable and undesirable impacts of old or new technologies as they are applied or innovated in society. Consideration is given to description and forecasting of immediate and derived effects, interactions, and potential irreversibilities. Students will collaborate in an assessment.

UNI 401 The Urban Crisis. 3(3-0) F. The change from a rural to an urban society, urban issues, the impact of technology and such resulting problems as poverty in affluence, racial tensions and changes in the environment. Controversial proposals discussed.

UNI 402 Peace and War in the Nuclear Age. 3(3-0) S. An interdisciplinary examination of the basic cluster of issues associated with the phenomena of peace and war. Areas of investigation include the nature of conflict, conflict management and resolution, aggression and violence, defense policy and nuclear strategic issues, the role of technology, arms races and arms control, and future prospects for world order.

UNI 490 Seminar in University Studies. 1-3 F.S. Investigation and discussion of selected topics of an interdisciplinary nature.

UNI 495 Special Topics in University Studies. 1-6 F.S. Examination of selected topics of an interdisciplinary nature.

Selected 500-Level Courses Open To Advanced Undergraduates

UNI 595 Special Topics in University Studies. Preq: Grad. standing or Cl. 1-3 F.S. Examination of selected topics of an interdisciplinary nature.

VETERINARY SCIENCE

VET 300 Laboratory Animal Management. Preq: Junior standing. 4(3-3) S. Designed to familiarize the student with the proper methods of handling, feeding, breeding, housing and disease control of the commonly used laboratory animals (mouse, rat, guinea pig, rabbit, hamster and nonhuman primates). Humane care is stressed throughout this study. Laboratory sessions will provide the student with an opportunity to handle, care for and rear a generation of one or more species during which time principles learned in lecture will be applied. Moncol

VET 333 Medical Vocabulary. Preq: Jr. or sr. enrolled in the pre-veterinary program. 2(2-0) S. Designed to familiarize students with a number of common medical terms through the use of Latin and Greek word parts and to teach pre-veterinary medical students the uses of a medical dictionary. Simmons

VET (PO) 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. Staff

VET (ANS) 420 Diseases of Farm Animals. Preqs: CH 101, 103. 3(3-0) S. The pathology of bacterial, viral, parasitic, nutritional thermal and mechanical disease processes. Batte

VET 490 Special Topics in Veterinary Science. Preq: Junior standing. 1-6 F.S. Offered as needed to cover new or special subject matter within the scope of veterinary science at the undergraduate level. Staff

Selected 500-Level Courses Open To Advanced Undergraduates

VET (MB, PO, PHY) 552 Immunobiology. 3(3-0) S. (See poultry science.)

VET 590 Advanced Special Topics in Veterinary Science. Preq: Sr. or grad. standing or Cl. 1-3 F.S. A course offered as needed to cover new or special subject matter within the scope of veterinary science at the graduate level. Graduate Staff

WOOD AND PAPER SCIENCE

WPS 101 Introduction to Wood and Paper Science. 1(1-0) F. Introduction to wood utilization in solid and fiber form, and curricula and careers in wood utilization. Staff

WPS 201 Elements of Wood. 3(2-3) S. For students not in Forest Resources. Identification, structure, properties and uses of common softwoods and hardwoods. Wood characteristics, moisture relationships and special features. Thomas

WPS 202 Wood Structure and Properties I. Preq: BS 100 or BO 200. 3(2-3) F. The macrostructure and microstructure of wood. Wood structure, the physical properties and uses of several commercially important coniferous and deciduous woods. Techniques of hand lens and microscope identification of wood. Wheeler

WPS 203 Wood Structure and Properties II. Preqs: WPS 202, PY 221 or 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. Hart

WPS 205 Wood Products Practicum. Preq: WPS 201 or 202. 5 Sum. Shop drawings and a bill of materials are prepared for a furniture item which is then constructed and finished. Processes include grading, drying, machining, gluing, assembly and coating. All wood and wood-based materials used are prepared. Plant trips supplement the simulated factory order. Staff

WPS 210 Forest Products Internship. Preq: Completion of summer practicum. 1 Sum. Experience in the forest products or related industries. The student is assigned problem solving in an industrial situation to gain insight of forest products technology. Students write a paper on their experience. Staff

WPS 211 Pulp and Paper Internship. Preq: Completion of soph. year. 1(1-0) S. Experience in the pulp and paper industry. The student is assigned problem solving in an industrial setting to gain insight of pulp and paper technology. Students write a paper on their experience. Staff

WPS 220 Wood Protection. Preqs: WPS 202, CH 103. 3(2-3) S. Description of the deterioration of wood by various agents such as fungi, insects, fire, weather, and chemicals, and the methods of protecting wood against their action. Goldstein

WPS 242 Wood Fiber Analysis. 3(2-3) S. Anatomy of wood and the relationship of anatomical structures to physical properties. Detailed microscopic studies of wood anatomy are conducted in the laboratory. Also, intensive laboratory work in the area of fiber microscopy with special emphasis on identification of pulped fibers from woody plants is included. Wheeler

WPS (FOR) 273 Quantitative Methods in Forest Resources. Preq: Soph. standing. 3(2-2) F.S. (See forestry.)

WPS 301 Wood Processing I. Preqs: WPS 201 or 202 and summer practicum. 3(2-2) F. The processes of drying, gluing and finishing wood. Processes of reconstituting wood as fiberboard, hardboard and particleboard. Basic requirements of various procedures and materials. Factors in selecting production methods. Kelly

WPS 302 Wood Processing II. Preqs: WPS 201 or 203 and summer practicum. 3(2-3) S. The theories and techniques of converting raw wood into usable products by milling, veneering and chipping round wood. The processing of finished lumber, dimension stock, plywood and other wood products. Kelly

WPS 315 Introduction to Wood-Polymer Principles. Preqs: WPS 203, CH 103. 2(2-0) F. Emphasis on basic organic and polymeric terminology necessary for understanding chemical components and macrostructure of wood. Introduction to the organic functional groups used in adhesives and finishes in wood products manufacturing. Goldstein

WPS 316 Wood-Polymer Principles. Preq: WPS 315. 3(3-0) S. Emphasis on the chemical and physico-chemical properties of wood based on its polymeric chemical structure. Finishing and adhesive systems widely used in wood products manufacturing are described and characteristics detailed. Goldstein

WPS 321, 322 Pulp and Paper Technology I, II. Preqs: CH 101, 107. 3(3-0) F.S. The physical and chemical characteristics of wood and cellulose. Chemistry and technology of the major mechanical, chemical and semichemical processes employed in the manufacture of pulp and paper. Processing of fibers into paper via the many commercial systems used in the paper industry. Hitchings

WPS 331 Introduction to Wood and Pulping Chemistry. Preq: CH 220. 1(1-0) F. Topics in organic chemistry required for a basic understanding of wood and pulping chemistry.

- Emphasis on carbonyl groups and aliphatic and phenolic hydroxyl groups as well as stereochemistry. Gratzl
- WPS 332 Wood and Pulping Chemistry.** Preqs: CH 220, WPS 331 or CH 221-223. 4(3-3) S. Wood as a basic source for fibers and chemicals. Major wood components including cellulose, hemicelluloses, lignin and extractives. Emphasis on the reactions of wood components in the major pulping and bleaching processes. Gratzl
- WPS 344 Introduction to Quality Control.** Preq: ST 361. 3(2-1) S. Methods used to control quality of manufactured wood products. Control charts of variables and attributes. Acceptance sampling techniques. Hart
- WPS 350 Wood Technology Literature.** Preq: Jr. standing in WST. 1(1-0) S. Introduction to scientific and trade journals by individual study of selected areas in marketing, processing, and utilization of wood-based materials with both oral and written reports of the findings. Kelly
- WPS 403 Paper Process Analysis.** Preqs: WPS 321, 322. 3(0-6) 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. Hitchings
- WPS 411, 412 Pulp and Paper Unit Processes I and II.** Preqs: CHE 301 and 302. 3(3-0) F.S. The principles of the design, construction and operation of process and auxiliary equipment employed in the pulp and paper industry. Processes include pulping, recovery, pollution reduction, recycling, fiber sources other than wood, papermaking, power (steam and electric) generation and utilization. Staff
- WPS 413 Paper Properties and Additives.** Preq: Sr. standing. 3(1-6) F. Physical, chemical, and microscopic testing of commercial papers; identification and evaluation of dyestuffs and color matching; nature and use of chemical additives in papermaking. Olf
- WPS (FOR) 423 Engineering Applications in Forest Resources.** Preq: Jr. standing. 3(2-3) F. (See forestry.)
- WPS 434 Wood Operation.** Preqs: WPS 301, 302. 3(2-3) F. Organization of manufacturing plants producing wood products, including company organization, plant layout, production planning and control. Analysis of typical manufacturing operations processes, equipment, size and product specification. The organization and operation of wood products markets. Staff
- WPS 441 Introduction to Wood Mechanics.** Preqs: MA 212, PY 221 or 211. 3(3-0) F. Strength and related properties of commercial woods; standard ASTM strength tests; toughness; timber fastening; design of columns; simple, laminated and box beams; trusses and arches. Pearson
- WPS 442 Wood Mechanics and Design.** Preq: CE 211 or WPS 441. 3(2-3) S. Wood as an engineering material. Topics include—generalized Hooke's law for orthotropic bodies and the effect of orientation of applied forces relative to the axes of symmetry; mechanical properties of wood as affected by its cellular structure; influence of defects, moisture, temperature and duration of load; visual and mechanical grading; derivation of working stresses; glued laminated construction; structural plywood; design of wooden members. Pearson
- WPS 450 Wood Industry Case Studies.** Preq: Sr. standing in WST. 2(1-3) S. Presentation of relevant wood industry problems involving material selection, process selection and managerial techniques for solution by the student. Staff
- WPS 461 Paper Converting.** Preq: Jr. standing. 1(1-0) S. The principal processes by which paper and paperboard are fabricated into products. Staff
- WPS 463 Plant Inspections.** Preq: Sr. standing in Pulp and Paper. 1(0-3) S. One-week inspection trips of representative manufacturers of pulp and paper and papermaking equipment. Hitchings
- WPS 471 Pulping Process Analysis.** Preq: WPS 321. 3(1-6) F. Predominately a laboratory course concerned with preparation and evaluation of different types of wood pulp. The wood raw material is varied each year to study the principal pulp and bleaching variables and

evaluate these critically. Students are organized in groups and encouraged to allocate time as necessary for experimental work.

Hitchings

WPS 481 Pulping Processes and Products. Preqs: WPS 202, CH 103. 2(2-0) S. Technology and economics of pulp products and by-products, including: paper and paperboard, containers and boxes, structural boards, molded and laminated products, cellulose fibers and films, cellulose derivatives and silvichemicals.

Staff

WPS (EB) 485 Management Development Seminar. Preq: EB 201 or 212. This course may not be used for credit toward an economics minor for any graduate degree. 3(3-0) S. (See economics.)

WPS 491 Senior Problems in Wood and Paper Science. 1-4 Arr. Management or technology problems selected with faculty approval.

Staff

Selected 500-Level Courses Open To Advanced Undergraduates

WPS 513 Tropical Woods. Preqs: WPS 203, 301. 2(1-3) F. Structure, identification, properties, characteristics and use of tropical woods, especially those used in plywood and furniture.

Wheeler

WPS 521, 522 Chemistry of Wood and Wood Products. Preqs: CH 315, CH 331, WPS 202, PY 212. 3(2-3) F,S. Fundamental chemistry and physics of wood and wood components; pulping principles, electrical and thermal properties.

Graduate Staff

WPS 525 Pollution Abatement in Forest Products Industries. Preq: Grad. or advanced undergrad. standing in science or engineering curricula. 3(3-0) S. Pollution sources, inplant control and treatment of water and air pollution in forest products with concentration on the pulp and paper industry.

Staff

WPS 533 Advanced Wood Anatomy. Preq: WPS 202 or CI. 3(1-6) Alt. S. Fundamental wood anatomy and cell wall ultrastructure. Laboratory techniques for light and electron microscopic studies of wood.

Thomas

WPS 540 . Wood Composites. Preqs: WPS 441; grad. or advanced undergrad. standing. 3(3-0) Alt. S. This course is designed to acquaint advanced undergraduate and graduate students with the rapidly expanding field of wood composites. Production processes for particleboard, plywood, hardboard, fiberboard, and other wood composites are presented. Elastic theory for the stiffness, strength, and buckling resistance of composites will be developed. Test procedures for determining mechanical properties and design procedures for glued laminated members, panel products, and built-up members, including I- and box-beams, stressed-skin panels and sandwich panels, will be outlined.

Graduate Staff

WPS 560 Advanced Pulp and Paper Process Analysis. Preqs: WPS 321 and 322. 3(3-0) S. Design and analysis of pulp and paper mill processes; process control applications in pulping, chemical recovery, bleaching and papermaking; principles of pulp mill chemical and energy recovery; and new alkaline pulping recovery technology.

Staff

WPS 591 Wood and Paper Science Problems. Preq: Sr. or grad. standing. Credits Arranged. Assigned to selected problems in the field of silviculture, logging, lumber manufacturing, pulp technology or forest management.

Graduate Staff

WPS 599 Methods of Research in Wood and Paper Science. Preq: Advanced undergrad. or grad. standing. Credit Arranged. Research procedures, problem outlines, presentation of results; consideration of selected studies by forest research organizations; sample plot techniques.

Graduate Staff

ZOOLOGY

ZO 201 General Zoology. Preqs: BS 100 or 105. 4(3-3) F,S,Sum. The biology of the major groups of animals, with emphasis on general structural plans and diversity, reproduction development, ecology, behavior and evolution.

G. Miller

ZO 202 Invertebrate Zoology. Preq: BS 100. 4(3-3) F,S. The biology and classification of invertebrate animals, especially types commonly encountered and those that illustrate zoological principles. Primarily for zoology and wildlife biology majors.

Bradbury

- ZO 203 Vertebrate Zoology.** Preq: BS 100 or BO 200. 4(3-3) F.S. The biology of the vertebrates; their adaptations and evolutionary history. Comparative physiological, developmental, behavioral and anatomical studies. Primarily for zoology and wildlife biology majors. Martof
- ZO 212 Basic Anatomy and Physiology.** Preq: BS 100 (only free elective credit allowed for students majoring in biological sciences, zoology, conservation and wildlife biology). 4(3-3) F. Major emphasis on the structure and function of the muscular, skeletal, circulatory and nervous systems. Grant
- ZO 221 Conservation of Natural Resources.** 3(3-0) F,S,Sum. The importance of natural resources to man and the part they play in his environment. The physical, biological and ecological principles underlying natural resource conservation with attention to the biological consequences of overexploitation and environmental pollution. Barkalow
- ZO 315 General Parasitology.** Preq: ZO 201 or 202. 3(2-3) S. To gain a knowledge and appreciation of the life history, pathology and control of some common parasites. G. Miller
- ZO 323 Comparative Anatomy.** Preqs: ZO 201, Jr. standing. 4(2-4) F,S. A comparative morphology of vertebrates demonstrating the interrelationships of the organ system of the various groups. Staff
- ZO 345 Histology.** Preq: ZO 323 or 203. 4(2-4) F. The microscopic anatomy of animal tissues. Muse
- ZO 353 Wildlife Management.** Preq: BS 100. 3(3-0) F,S. 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. Barkalow
- ZO (BO) 360 Introduction to Ecology.** Preq: A 200 level biology course. 4(3-3) F,S. Sum. (See botany.)
- ZO 361 Vertebrate Embryology.** Preq: ZO 323 or 203. 4(3-3) S. Fundamental principles that apply to the embryonic development of vertebrates. Roberts
- ZO 400 Biological Basis of Man's Environment.** Preq: Jr. standing. 3(3-0) S. Man's impact on the environment and the biological laws that govern the consequences in terms of population growth, pollution, and ecology. Staff
- ZO (BO) 414 Cell Biology.** Preqs: CH 223, PY 212, ZO 201 or 203. 3(3-0) F. The chemical and physical bases of cellular structure and function with emphasis on methods and interpretations. Roberts
- ZO 415 Cellular and Animal Physiology Laboratory.** Coreq: ZO 414 or ZO 421. 2(0-5) F,S. An introduction to physiological techniques and experimentation. Laboratory experiments include studies of cells and examination of the functions of vertebrate organ systems. Smith
- ZO 420 Fishery Science.** Preqs: ZO 201 or 203, ZO 360. 3(2-2) F. The science of fishery biology: life history and biology of important game and commercial fishes, fishing methods, age and growth analysis, survey of fishery resources, tagging studies, population estimations and pollution studies. Hassler, Huish
- ZO 421 Vertebrate Physiology.** Preqs: CH 223, PY 212, ZO 201 or 203. 3(3-0) F,S. A comprehensive study of the processes involved in the function of specialized cells, tissues and organ systems of vertebrates. Emphasis is on the study of mammalian systems. Smith, Underwood
- ZO (ENT) 425 General Entomology.** Preq: ZO 201 or equivalent. 3(2-3) F,Sum. (See entomology.)
- ZO 441 Ichthyology.** Preqs: ZO 201 or 203; jr. standing. 3(3-0) S. A study of the origin, evolution, and classification of fishes. Detailed information is presented on the biology, life history, ecology, and economics of selected species. Hassler
- ZO 442 Ichthyology Laboratory.** Preq: ZO 201 or 203; Coreqs: ZO 441; jr. standing. 1(0-3) S. Concerned with methods of collecting and preserving fish for scientific use. Provides the

student with the basic background to identify and classify fish. The student also becomes familiar with fish distribution and ecology. Hassler

ZO 490 Special Topics in Zoology. Preq: Jr. standing. 3(2-1).

Selected 500-Level Courses Open To Advanced Undergraduates

ZO 501 Ornithology. Preqs: ZO 323 or 203, ZO 421. 3(2-3) F.S. The biology of birds: systematics, physiology, life histories, ecology and behavior. Quay

ZO 510 Adaptive Behavior of Animals. Preq: ZO 421 or CI. 4(3-3) F. The comparative study of animal behavior including a treatment of physiological mechanisms and adaptive significance. Both invertebrates and vertebrates are studied. Whitsett

ZO (PHY) 513 Comparative Physiology. Preq: ZO 421 or CI. 4(3-3) S. A comparative study of the organ systems of vertebrates and the physiological processes involved in maintaining the homeostatic state. The various compensatory mechanisms employed during environmental stress are included. Underwood

ZO 515 Growth and Reproduction of Fishes. Preqs. or coreqs: GN 411, ZO 420, 421, 441. 3(2-3) S. The biology of fishes: physiology, anatomy, pathology, behavior and genetics. This course is designed especially for graduate students in fisheries. Several trips to research laboratories are taken. (Offered S 1979 and alt. years.) Huish

ZO 517 Population Ecology. Preqs: ZO (BO) 360 and ST 511 or equivalent. 3(3-0) S. The dynamics of natural populations. Current work, theories and problems dealing with population growth, fluctuation, limitation and patterns of dispersion, the ecological niche, food chains and energy flow. Emphasis on methods of study. Hayne

ZO 519 Limnology. Preq: ZO (BO) 360 or equivalent. 4(3-3) F. A study of inland waters. Lectures dealing with physical, chemical and biological factors that affect freshwater organisms. General principles are illustrated in the laboratory and on field trips. Mozley

ZO (PO) 524 Comparative Endocrinology. 4(3-3) S. (See poultry science.)

ZO (MSE) 529 Biological Oceanography. Preq: ZO (BO) 360 or CI. 3(3-0) F. A comprehensive course stressing the dynamic interrelationships between organisms of the sea and their physical and chemical environment. The latter part of the course will examine fundamental concepts in biological oceanography and will particularly stress experimental methods. J. M. Miller

ZO (GN) 532 Biological Effects of Radiations. 3(3-0) S. (See genetics.)

ZO (GN) 540 Evolution. 3(3-0) F. (See genetics.)

ZO 542 Herpetology. Preqs: ZO 323 or 203, ZO 421. 3(2-3) S. The biology of the amphibians and reptiles: systematics, life history, anatomy, behavior, physiology and ecology. Martof

ZO 544 Mammalogy. Preqs: ZO 323 or ZO 203, CI. 3(2-3) S. The classification, identification and ecology of the major groups of mammals. Barkalow

ZO (GN) 550 Experimental Evolution. 3(3-0) F. (See genetics.)

ZO 553 Principles of Wildlife Science. Preq: ZO (BO) 360. 3(2-3) F. The principles of wildlife management and their application are studied in the laboratory and in the field. Doerr

ZO 554 Wildlife Field Studies. Preqs: ZO 553, ST 311; CI. 3(2-3) S. Field application of methods for studying vertebrate wildlife populations; sampling methods, data gathering, analysis, and interpretation of results are practiced. Participation in field laboratories and one or two weekend field trips is required. Doerr

ZO (MB) 555 Protozoology. Preq: CI. 4(2-6) S. The biology of the Protozoa: lectures include morphology, physiology, ecology, genetics, reproduction, evolution, systematics and life-cycles of both free-living and parasitic taxa; laboratory will stress recognition of selected forms and demonstrate techniques used to prepare specimens for microscopic examination. Bradbury

ZO (BO) 560 Principles of Ecology. Preq: Three semesters of college-level biology courses. 4(3-3) F. A consideration of the principles of ecology at the graduate level. Each of the major subject areas of ecology is developed in sufficient depth to provide a factual and philosophical framework for the understanding of ecology. Graduate Staff

ZO (PHY, ENT) 575 Physiology of Invertebrates. 3(3-0) S. (See physiology.)

ZO 581 Helminthology. Preqs: ZO 323 or 203, ZO 315 or equivalent. 4(2-4) F. The study of the morphology, biology and control of the parasitic helminths. G. C. Miller

ZO (ENT) 582 Medical and Veterinary Entomology. 3(2-3) S. (See entomology.)

ZO 590 Special Studies. Preqs: Twelve hours ZO, CI. Credits Arranged. F,S. A directed individual investigation of a particular problem in zoology, accompanied by a review of the pertinent literature. A maximum of three hours is allowed toward the master's degree. Graduate Staff

ZO 592 Topical Problems. Preq: CI. 1-3 F,S. Organized, formal lectures and discussion of a special topic. Graduate Staff



Students are important at North Carolina State University. The resources and energies focused on making students' academic and extracurricular experience highly successful rank among the best.



Winning athletics teams in nearly a score of competitive sports have the enthusiastic support of N. C. State students, alumni and friends.

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University Government

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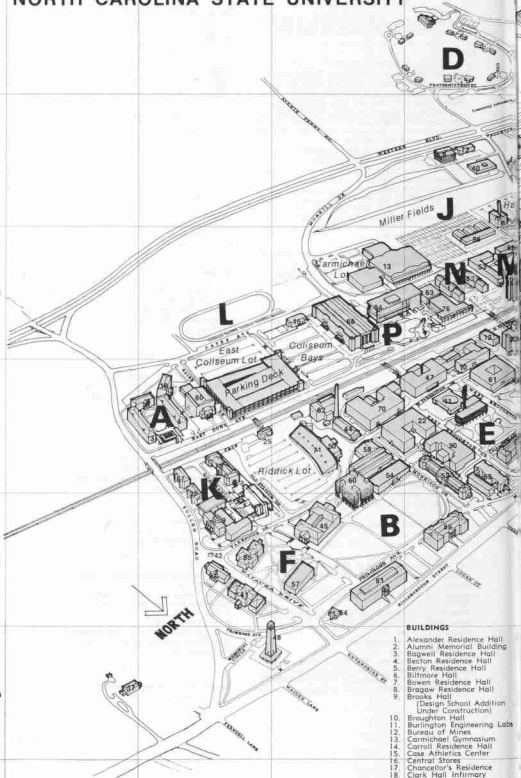
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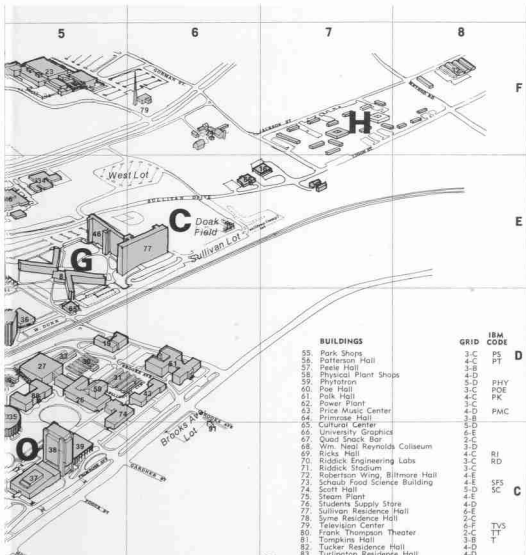
F
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1 2 3 4



- BUILDINGS**
1. Alexander Residence Hall
 2. Alumni Memorial Building
 3. Bagwell Residence Hall
 4. Becton Residence Hall
 5. Berry Residence Hall
 6. Billmore Hall
 7. Bowen Residence Hall
 8. Baggaw Residence Hall
 9. Brooks Hall
(Design School Addition Under Construction)
 10. Broughton Hall
 11. Burlington Engineering Labs
 12. Bureau of Mines
 13. Carmichael Gymnasium
 14. Carroll Residence Hall
 15. Case Athletics Center
 16. Central Stores
 17. Chancellor's Residence
 18. Clark Hall Infirmary

1 2 3 4



BUILDINGS	GRID	IBM CODE
19. Clark Laboratories	5-D	
20. Cox Hall	4-D	
21. Dabney Hall	4-D	
22. Darnesi Hall	4-C	
23. McKimmon Extension Education Center	3-F	
24. Farm Unit 5	6-F	
25. Field House	2-C	
D. Fraternity Court	4-F	
26. Gardner Hall	5-D	
27. Gardner Hall Addition	5-D	
28. Gold Residence Hall	5-D	
29. Greenhouse—Agronomy	5-D	
30. Greenhouse—Biological Sciences	5-D	
31. Greenhouse—Horticulture	5-D	
32. Greenhouse—840 Method Rd.	8-F	
33. Greenhouse—Plant Pathology	5-D	
34. Grinnell Animal Health Lab	5-F	
35. Harrelson Hall	5-D	
36. Harris Hall	5-D	
37. D. H. Hill Library—original wing	5-C	
38. D. H. Hill Library—book stack tower	3-C	
39. D. H. Hill Library—Erdahl-Cloyd wing	5-C	
40. Hodges Wood Products Lab	4-E	
41. Holiday Hall	2-B	
42. Information Center	2-B	
43. Kilgore Hall	6-D	
44. Laundry	3-C	
45. Leazar Hall	3-B	
46. Lee Residence Hall	5-E	
47. Mott Hall	5-C	
48. Memorial Tower	7-F	
H. E. S. King Village (17 opt. bldgs. A-Q)	3-A	
49. Metcalf Residence Hall	4-D	
50. Morris Building	3-C	
51. Nelson Textile Building	6-D	
52. 1717 Building	4-C	
53. Owen Residence Hall	4-D	
54. Page Hall	3-C	

BUILDINGS

55. Park Shops	3-C
56. Patterson Hall	3-B
57. Peele Hall	3-B
58. Physical Plant Shops	4-D
59. Phylatron	5-D
60. Poe Hall	3-C
61. Polk Hall	4-C
62. Power Plant	3-C
63. Price Music Center	4-D
64. Primrose Hall	3-B
65. Cultural Center	5-D
66. University Graphics	5-E
67. Quad Snack Bar	3-C
68. Wm. Neal Reynolds Coliseum	3-D
69. Ricks Hall	4-C
70. Riddick Engineering Labs	3-C
71. Riddick Stadium	3-C
72. Robertson Wing, Biltmore Hall	4-E
73. Schaub Food Science Building	4-E
74. Scott Hall	5-D
75. Steam Plant	4-E
76. Students Supply Store	4-D
77. Sullivan Residence Hall	6-E
78. Syme Residence Hall	2-C
79. Television Center	2-C
80. Frank Thompson Theater	3-C
81. Tompkins Hall	3-B
82. Tucker Residence Hall	4-D
83. Turlington Residence Hall	4-D
84. University Student Center	3-D
85. Watauga Hall	3-B
86. Weaver Laboratories	3-B
87. Welch Residence Hall	2-C
88. Williams Hall	3-D
89. Winston Hall	4-B
90. Withers Hall	4-C
91. Turner House	6-C

COURTS AND FIELDS

COURTS AND FIELDS	GRID
A. Becton-Berry Quad	2-C
B. Court of North Carolina	3-B
C. Doak Field	6-E
D. Fraternity Court	4-F
E. Gardner Arboretum	4-C
F. Holiday Hall Court	3-B
G. Lee-Brogaw Court	3-E
H. E. S. King Village	7-F
I. Miller Fields	4-C
J. Miller Fields	4-C
K. Syme-Brooks Court	2-C
L. Track	2-D
M. Tucker-Owen Court	3-B
N. Turlington-Alexander Court	5-D
O. University Plaza	4-C
P. University Student Center Plaza	3-D

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Parking Deck	2-C
Riddick Lot	3-C
West Lot	6-E
Sullivan Lot	6-E
Sullivan Temporary Lot	7-E

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