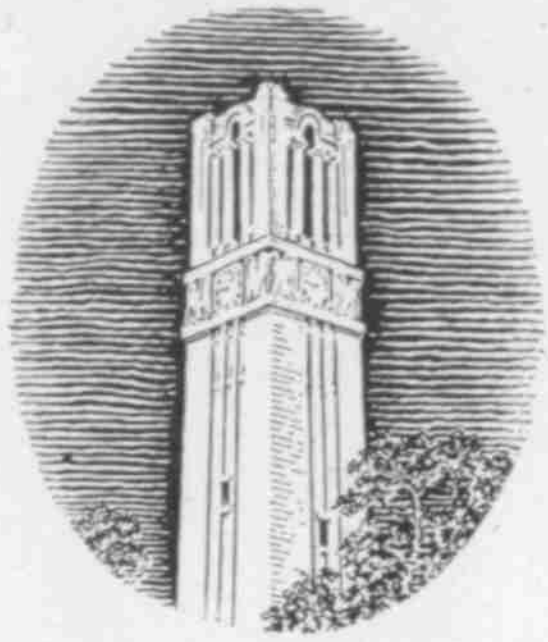
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TATE COLLEGE RECORD

1958-1960

GENERAL CATALOG - Second Issue
August, 1959
NORTH CAROLINA STATE COLLEGE

NORTH CAROLINA STATE COLLEGE RECORD



NORTH CAROLINA STATE COLLEGE

OF

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THE CONSOLIDATED UNIVERSITY OF NORTH CAROLINA

(Offices at Chapel Hill)

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COLLEGE CALENDAR, 1958-60

FALL SEMESTER, 1958

September 8	Monday	General Faculty Meeting, 3 p.m.
September 8-10	Monday-Wednesday	New Student Orientation and Testing.
September 11	Thursday	Freshman Registration.
September 12	Friday	Upperclass Registration. Late Registration Fee of $5.00 payable by all who register after September 12.
September 12-13	Friday-Saturday	Continuation of New Student Orientation and Testing.
September 15	Monday	Classes Begin.
September 19	Friday	Last Day for Registration. Last Day for Refund less $5.00 Registration Fee.
September 26	Friday	Last Day to Add a Course.
October 3	Friday	Last Day to Drop a Course without Failure.
November 3	Monday	Graduate Executive Council 3 p.m. Consolidated University office, Chapel Hill.
November 8	Saturday	Mid-Term Reports.
November 26	Wednesday	Thanksgiving Holiday begins at 1 p.m.
December 1	Monday	Classwork Resumes.
December 2	Tuesday	Last Day to Withdraw from School without Failures.
December 16	Tuesday	Christmas Holiday begins at 12 noon.
January 5, 1959	Monday	Classwork Resumes.
January 17	Saturday	Last Day of Classes.
January 19-24	Monday-Saturday	Final Examinations.
January 26	Monday	Awarding of Degrees for Graduating Students.

SPRING SEMESTER, 1959

January 29	Thursday	Orientation and Testing of New Students.
January 30	Friday	Registration. Late Registration Fee of $5.00 payable by all who register after January 30.
February 2	Monday	Classes Begin.
February 6	Friday	Last Day for Registration. Last Day for Refund less $5.00 Registration Fee.
February 13	Friday	Last Day to Add a Course.
February 20	Friday	Last Day to Drop a Course without Failure.
March 21	Saturday	Mid-Term Reports.
March 25	Wednesday	Easter Holiday begins at 6 p.m.
April 2	Thursday	Classwork Resumes.
April 3	Friday	Last Day for Withdrawing from School without Failures.
April 6	Monday	Graduate Executive Council 3 p.m. Consolidated University office, Chapel Hill.
May 23	Saturday	Last Day of Classes.
May 24	Sunday	Commencement.
May 25-30	Monday-Saturday	Final Examinations.

SUMMER SESSIONS, 1959—two six-weeks sessions

First Session

June 8	Monday	New Student Orientation and Testing.
June 9	Tuesday	Registration. Late registration fee of $5.00 payable by all registering after June 9.
June 10	Wednesday	Classes begin.
June 15	Monday	Last day for registration. Last day for any refund.
June 19	Friday	Last day for dropping a course without failure.
July 6	Monday	Last day to withdraw from school without failures.
July 15	Wednesday	Last day of classes.
July 16, 17	Thursday-Friday	Final examinations.

Second Session

July 20	Monday	New Student Orientation and Testing.
July 21	Tuesday	Registration. Late registration fee of $5.00 payable by all registering after July 21.
July 22	Wednesday	Classwork begins.
July 27	Monday	Last day for registration. Last day for any refund.
July 31	Friday	Last day for dropping a course without failures.
August 14	Friday	Last day to withdraw from school without failures.
August 25	Tuesday	Last day of classes.
August 26, 27	Wednesday-Thursday	Final examinations.

FALL SEMESTER, 1959

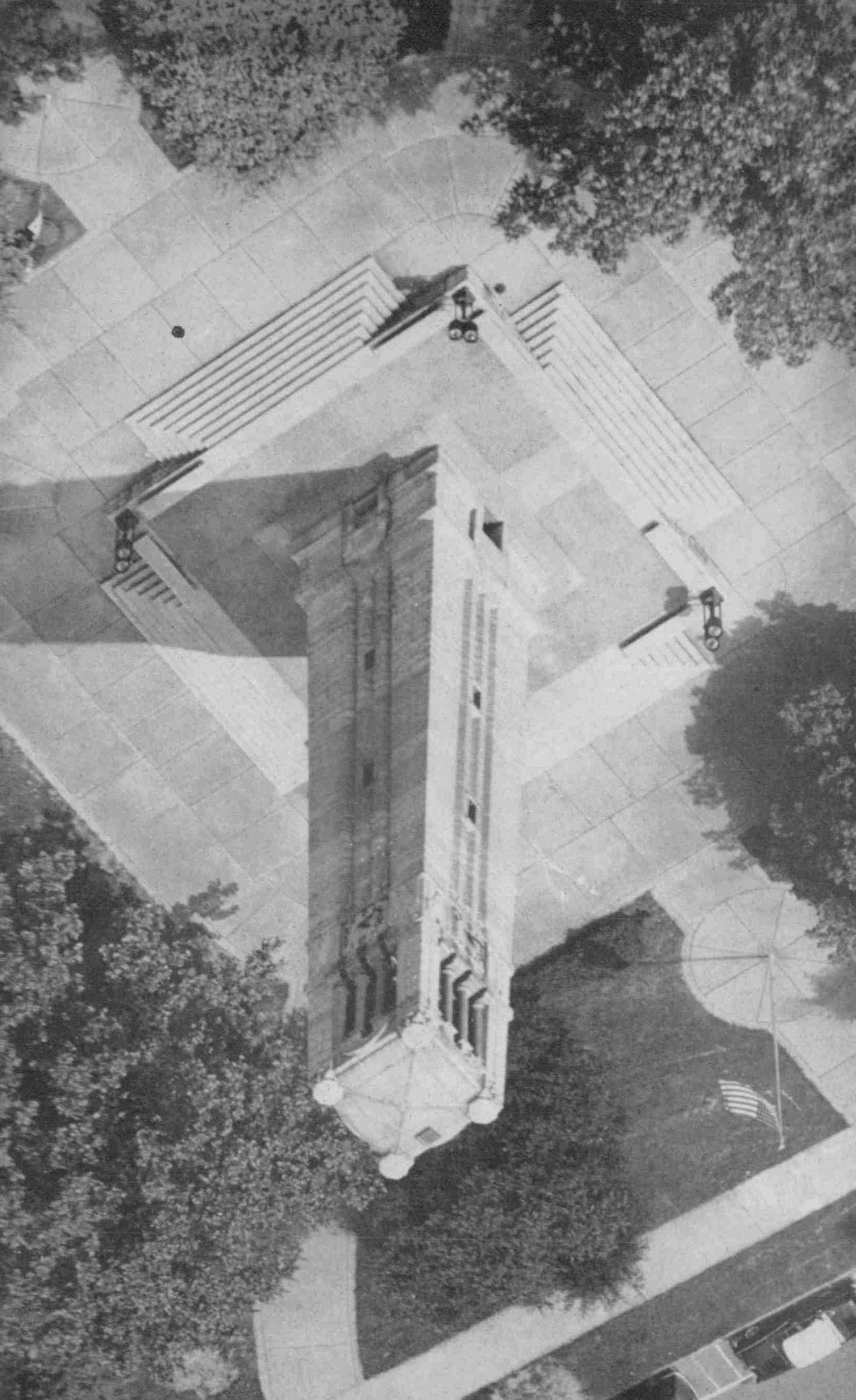
Sept. 14	Monday	General Faculty Meeting.
Sept. 14-16	Monday-Wednesday	New Student Orientation.
Sept. 17	Thursday	Freshman Registration.
Sept. 18	Friday	Upperclass Registration. Late Registration fee of $5.00 payable by all who register after September 18th.
Sept. 18-19	Friday-Saturday	Continuation of New Student Orientation.
Sept. 21	Monday	Classes begin. 8:00 a.m.
Sept. 25	Friday	Last day for Registration. Last day for refund, less $5.00 Registration fee.
Oct. 2	Friday	Last day to add a course.
Oct. 9	Friday	Last day to drop a course without failure.
November 2	Monday	Graduate Executive Council 3 p.m. Consolidated University office, Chapel Hill.
November 14	Saturday	Mid-term reports.
November 25	Wednesday	Thanksgiving holiday begins at 1 p.m.
November 30	Monday	Classwork resumes. 8:00 a.m.
December 1	Tuesday	Last day to withdraw from school without failures.
December 16	Wednesday	Christmas holidays begin at 6 p.m.
January 4, 1960	Monday	Classwork resumes. 8:00 a.m.
January 23	Saturday	Last day of classes.
January 25-30	Monday-Saturday	Final examinations.
February 1	Monday	Awarding of Degrees for Graduating Students.

SPRING SEMESTER, 1960

February 4	Thursday	Orientation of new students.
February 5	Friday	Registration. Late Registration fee of $5.00 payable by all who register after February 5th.
February 8	Monday	Classes Begin. 8:00 a.m.
February 12	Friday	Last day for Registration. Last day for refund less $5.00 registration fee.
February 19	Friday	Last day to add a course.
February 26	Friday	Last day to drop a course without failure.
March 26	Saturday	Mid-term Reports.
April 4	Monday	Graduate Executive Council, 3 p.m. Consolidated University office, Chapel Hill.
April 13	Wednesday	Easter Holiday begins at 6 p.m.
April 21	Thursday	Classwork Resumes. 7:30 a.m.
April 22	Friday	Last day for withdrawing from School without failures.
May 28	Saturday	Last day of classes.
May 29	Sunday	Commencement.
May 30-June 4	Monday-Saturday	Final Examinations.

Its (N. C. State's) general purpose is to so teach the principles and application of the sciences, illustrating sound theory by daily practice, as to make of its students useful and successful men, instead of mere intelligent drones.

Alexander Quarles Holladay
President, 1889-1899



← MEMORIAL TOWER

NORTH CAROLINA STATE COLLEGE

I. GENERAL INFORMATION

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NORTH CAROLINA STATE COLLEGE

ITS HERITAGE

North Carolina State College is a community dedicated to the pursuit of inquiries into the nature of the world and man, and to the training of students in understanding and participating in such inquiries. Founded by legislative act of March 7, 1887, it is the State's technological institution of higher learning and Land Grant College.

Vitally important to the establishment of the College was the growing sentiment in North Carolina at that time to make the State more self-sufficient economically and less "dependent on the North for technical experts and manufactured articles of daily use." Further impetus was provided by the fact that although the Morrill Land Grant Act of 1862 authorized the use of public land or its equivalent in land scrip for the creation of an agricultural college in each state, North Carolina had not established such a specialized institution.

The North Carolina College of Agriculture and Mechanic Arts opened its doors for the first time on October 3, 1889, welcoming 45 students to a faculty of six teachers and to a campus of one building, one stable, two mules, one horse, and a 60-acre farm on which most of the students could "work out" their education. The first president was Colonel Alexander Q. Holladay, for whom the first building was later named.

In 1931, the General Assembly formed the Consolidated University of North Carolina, taking in the University at Chapel Hill, State College at Raleigh, and the Woman's College at Greensboro. Since consolidation, State College has developed rapidly to meet the growing industrial needs of North Carolina and the increasing interest in scientific agriculture within its borders.

Following World War II, when college personnel and facilities were involved primarily in the national defense effort, State College witnessed a tremendous expansionary movement. Returning service men nearly tripled any previous enrollment, and today's student body has stabilized at twice the pre-war level. A much expanded building program has provided more than fifteen million dollars in augmented physical facilities, so that State College today is one of the best-housed and best-equipped technical schools in the nation. Through these expanded operations, State College has grown in size and service to the people of North Carolina and in prestige throughout the nation and the world for its diverse programs in teaching, research and extension services. Now in its 69th year of service, the College has a regular enrollment averaging 6,000 in a $35 million plant, on a campus of 72 major buildings, seven schools, 48 departments, with a teaching staff of nearly 600 and a total staff of nearly 2,000, including administrative, extension, and research personnel across the State.

Students at State College can be justly proud of its rich heritage, including the well-trained alumni who are helping to build a better world by applying their technical knowledge to the variety of social problems that occur to men living in groups. Their important contributions range from building bridges over giant chasms to designing and constructing homes and buildings which are pleasant, comfortable and harmonious with modern ways of living; from building dams and power plants which permit irrigation and give light and power to millions, to teaching farmers all that science has learned about agriculture; from clothing the civilized world in the finest and most durable raiment the textile industry can produce to preserving and replanting our forests; from building highways throughout the land to creating new magic in chemistry and ceramics; from developing and conserving our natural resources to extending the frontiers of knowledge about all these matters through research projects.

ITS SERVICES AND DIVISIONS

The major objective of North Carolina State College is to provide an opportunity for students to obtain the highest level of scientific and technical training and, at the same time, the broad general education which is a basic prerequisite to specialization. The College has taken the position that man is first a citizen and then a specialist. He must be able to participate as a full-fledged member in the life of the community and to make informed judgments about the great variety of problems which the citizen faces. In working toward this broad objective, State College is organized into seven main instructional divisions: School of Agriculture, School of Design, School of Education, School of Engineering, School of Forestry, School of General Studies, and School of Textiles.

With the exception of the School of General Studies, each of these divisions offers numerous curricula leading to baccalaureate degrees. These curricula are explained in detail in Part III of this bulletin. In addition, through its Graduate School, the College offers advanced degrees: Master or Master of Science in various departments of the Schools of Agriculture, Education, Engineering, Forestry and Textiles; Doctor of Philosophy in certain curricula in Agriculture, Engineering, and Forestry. The School of General Studies works with all State College students in the areas of the liberal arts. It is that part of State College especially concerned with helping the student to understand the nature of man, the ideas and institutions which he has built and which in turn have helped to shape his nature, the relation between him and his fellows, and the world in which he lives.

Other divisions of the College are the Agricultural Experiment Station, The College Extension Division, The Agricultural Extension Service, and The Institute of Statistics. Allied agencies with headquarters on the campus include the United States Bureau of Mines Regional Laboratories; the state office of the Agricultural Stabilization and Conservation Administration; and offices of the State center of the United States Department of Agriculture.

The services of State College reach the citizenry of the state through six principal ways: (1) resident instruction; (2) off-campus instruction in established courses through the College Extension Division; (3) off-campus demonstration through the Agricultural Extension Service; (4) special instruction in technical institutes; (5) industrial and agricultural research —both basic and applied; and (6) direct contact with the home through the media of radio and television. All of the research and instruction at State College are keyed to problems in the economic and cultural life of the State and region, and seek to extend the agricultural and industrial development of the whole area.

ITS CAMPUS

In the broadest sense, the campus of North Carolina State College extends, through its services, to the boundaries of the State and beyond into the whole southern region. But the focal center of these widespread activities is the college campus in Raleigh, the State's historic capital city, where students have access to a rich reservoir of art treasures, library facilities, churches, and other cultural assets.

Adjoining the central campus at Raleigh are the college farms. In addition to these holdings in the Raleigh area, the State College Experiment Station operates a number of forest farms in every climatic and geographical area of the state, and the School of Forestry has large holdings of experimental woodlands in the Coastal Plain, the Piedmont, and the mountain regions of North Carolina.

Recent building additions to the main campus include two new dormitories, eleven new and four renovated teaching, research-extension build-

ings, a new library, Reynolds Coliseum, a modern College Union, and a nuclear reactor for the development of peacetime atomic research. The State College campus has grown from colonial and classical architecture on the old or east campus to the latest expression in modern architecture on the new or west campus. Good examples of the traditional east campus are Holladay and Pullen. Good examples of the modern west campus are the College Union and Burlington Laboratory.

Of the buildings, new and old, a few deserve special mention.

The Memorial Tower . . . a 116-foot campanile of white Mount Airy granite, designed by William Deacy, begun by alumni in 1921 as a monument to the 33 State College men who lost their lives in World War I, expanded in 1937, and completed in 1949.

Andrew Johnson House . . . birthplace (1808) of the 17th President of the United States, a tiny, gambrel-roof frame structure, removed from original site on Fayetteville Street to Pullen Park, and in 1937 moved here (admission on application to keeper).

Holladay Hall . . . oldest building on campus, once the total college plant, now completely remodeled inside, housing central administration.

The YMCA . . . a traditional landmark in the heart of the old campus, serving the religious and social life of the college, recently remodeled and dedicated The E. S. King Religious Center.

William Neal Reynolds Coliseum . . . one of America's largest indoor stadiums, seating 12,500 for sports events and more for stage events using the floor, attracting nation-wide basketball games, ice-shows, agricultural meetings, symphonies, variety shows, and lecturers.

Burlington Laboratory . . . home of the Nuclear Reactor, which has attracted national attention as first nuclear pile to be used entirely for teaching and research, first to be operated on any college campus as a non-AEC reactor, first to be open for public inspection.

College Union . . . one of nation's most modern student-faculty activities centers, with a main lounge, cloak room, snack bar, dining room, 2 private banquet rooms, ballroom, self-operating elevator, several telephones, direct telegraph connection, TV sets, Quiet Room, library game room, barber shop, 160-seat theater, private rooms with a private balcony, 7 meeting rooms, and hobby shop.

Clark Infirmary and Leazar Dining Hall . . . modern buildings, well-equipped for their services to the student body.

Other points of interest . . . are the modern greenhouses accompanying Williams, Gardner, and Kilgore halls; Animal Disease Laboratory, Pulp and Paper Laboratory, Nelson School of Textiles, Riddick Engineering Laboratories, Brooks Hall (a union of traditional and contemporary architecture), and TV Studios along Western Boulevard.

Now under construction is a fine new gymnasium designed to replace the antiquated Frank Thompson Gym, and a completely modern classroom building, close to the library and the student center of the campus.

May it (N. C. State) rejoice in work, not dreaming dreams but doing deeds.

May it ennoble toil, abolish drudgery, harness nature to human service, and create for all mankind larger and better health, wealth, comfort, and happiness!

May its mission in life, its achievements in education, its brilliant guiding star be the wise words of the sacred seer: "There is nothing better than that a man should rejoice in his work."

George Tayloe Winston
President, 1899-1908

← COLLEGE UNION

II. REGULATIONS AND PROCEDURES FOR STUDENTS

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ADMISSION REQUIREMENTS — — — — — — — — —

First, an application form must be submitted. These forms, which indicate completely what information is required, may be obtained from and should be submitted to:

Director of Admissions
Holladay Hall
North Carolina State College
Raleigh, North Carolina

Applications for admission will be considered between **February 1** and **September 1** for the fall semester; and between **October 1 and January 1** for the spring semester. For admission of Graduate Students, see the special catalog of the Graduate School which may be obtained from:

Dean of the Graduate School
Gardner Hall
North Carolina State College
Raleigh, North Carolina

Courses of study at North Carolina State College assume the entering student has competence in oral and written expression, efficient study and reading skills, the mathematical skills normally gained in secondary school instruction, and broad preparation in approved fields of study. By action of the Board of Trustees students entering any unit of the Consolidated University must take entrance examinations as prescribed from year to year. Information concerning these tests can be secured from the Office of Admissions.

The College enrolls undergraduate students in four classifications: regular (degree-seeking students); special (no college credit); unclassified (may be changed subsequently to regular status using credits earned while unclassified); and auditor (no credit).

To be admitted to a department as a regular, degree-seeking student, freshmen must submit a certificate of graduation from an accredited high school or, in the case of graduation from a non-accredited high school, pass a special entrance examination. Regular, degree-seeking transfer students must present official transcripts of work taken at other institutions. Detailed regulations which apply in all cases are discussed in the following paragraphs and should be examined carefully by the prospective student.

ADMISSION BY CERTIFICATE OF GRADUATION — — — — — —

The applicant should be (a) at least 16 years of age; (b) of sound moral character; and (c) the graduate of an accredited high school. He should present at least 15 units of completed high school work, 8½ of which are distributed as follows:

English (or English and Speech)	4 units (see below)
Mathematics	2½ to 4 units (see below)
History and Social Science	1 or 2 units (see below)
Natural Science	1 or 2 units

The remainder of the 15 units will be accepted from other courses, except that not more than one unit will be accepted from activity courses such as physical education, music, band, or military science.

ENGLISH COMPOSITION

All students entering North Carolina State College for the first time are tested for their proficiency in using the English language. Students deficient in this area are required to take a special non-credit course in English composition and to make satisfactory progress in the work before taking the regular credit course in English. This remedial work may be taken in summer school prior to the entering semester, by correspondence, or may be taken as an evening course at additional cost. Students who make high

marks on this examination and who demonstrate unusual proficiency in special written exercises may be excused from taking the regular credit course in English composition. Instead, they receive credit for the course and proceed to advanced courses.
Foreign students who do not have a satisfactory command of English are required to take special courses in English for Foreign Students until they are skillful enough in the language to continue their work.

MATHEMATICAL PREPARATION

Since mathematics is of such great importance in present-day technical curricula, State College requirements are somewhat rigorous in this area of the student's preparation. One and one-half units of algebra and one unit of plane geometry are considered minimum preparation for all curricula. Students presenting only one unit of algebra or no plane geometry must take special non-credit courses to meet these deficiencies. Courses scheduled to meet deficiencies in these areas will not carry college credit. Registration in regular college courses in mathematics will be delayed until this work is completed. Students in Engineering, Design, Agricultural Engineering, Agricultural and Biological Chemistry, and Mathematics Education are required to present solid geometry for admission. A special non-credit course is offered for applicants who have not taken the work in high school. All deficiencies in mathematics may be removed by attending the summer sessions prior to regular enrollment, by correspondence or may be removed by taking evening courses at additional cost. No student may begin his regular work in mathematics until deficiencies are removed. It is wise for the student planning to enter any of these curricula to make every effort to complete required courses in mathematics in high school before applying to State College, or to take them in summer school, or by correspondence, at the College prior to entering as a freshman in the fall.

HISTORY AND POLITICAL SCIENCE

If the student does not offer American History for admission, he must complete one semester of American History or American Government as part of his college program. If he is officially registered for the course, he will receive college credit for it. Foreign students are required to complete a course in American History before graduation.

— — — — — — — — — — ADMISSION BY SPECIAL EXAMINATION

Students who have been graduated from non-accredited high schools and mature students who have not completed high school work may qualify for acceptance as students working for a degree by passing entrance examinations. These examinations will cover approximately the work expected of regular high school graduates.

— — — — — — — — ADMISSION AS A MATURE SPECIAL STUDENT

Mature students who do not wish to work for a degree may be admitted to the college in this category upon recommendation of the Dean of the school concerned and upon submission of satisfactory records of education and experience. The usual college entrance requirements may be waived for mature students, but regular college rules of scholarship will apply after admission. The special student may not represent the College in any inter-collegiate contest or become a member of any fraternity, professional or social.

— — — — — — — — – ADMISSION AS AN UNCLASSIFIED STUDENT

Admission as an unclassified student requires the recommendation of the Dean of the school in which the student wishes to enroll. Unclassified students must meet the same requirements as regular students and must

adhere to the rules and regulations of the College. If at a later date an unclassified student wishes to change to regular status, his credits must be evaluated for his major. Credits earned by the student while he is unclassified will be accepted only if he has completed the proper prerequisites. Where credit is allowed, the student will receive the grades he earned in the courses accepted for credit.

ADMISSION BY PRESENTING EVIDENCE OF CREDIT EARNED FROM ANOTHER ACCREDITED INSTITUTION OF HIGHER LEARNING — — —

All students who transfer to State College from other colleges must present official transcripts of work taken at the other institutions. A complete separate, official transcript must be sent directly to the Admissions Office from each institution attended. The prospective transfer student must be eligible to return to the institution last attended. The student's record, if of average grade or above, will be evaluated by the Dean or Director of Instruction of the School in which the student wishes to register. A $2.00 transcript evaluation fee, payable to the Office of Registration, is charged for this service. Evaluation by the school will be final. Students whose records show below average work cannot be admitted to State College unless such admission is approved by the Admissions Committee. Failure of the student to present transcripts from all colleges previously attended may result in his dismissal from College.

ADMISSION AS AN AUDITOR — — — — — — — — —

Students who wish to audit courses must obtain the permission of the instructor and department head and register through the Office of Registration. The participation of auditors in class discussion or in tests or examinations is optional with the instructor. Auditors receive no credit for the course; they are, however, expected to attend classes regularly.

RESIDENCE — — — — — — — — — — — — —

State College is unable to accept all the out-of-state applicants for admission. By trustee action, the College can accept only highly qualified out-of-state students. The administration has ruled that all students whose parents have not been domiciled in North Carolina for more than six months immediately preceding the day of their first enrollment in the institution shall be termed out-of-state students, with the following exceptions:

Students twenty-one years of age at the time of their first matriculation who have resided in North Carolina for more than one year, other than by virtue of attendance at another college or temporary military assignment, preceding the day of their first enrollment.
Children of regular employees of the Federal Government stationed in the State of North Carolina; and
Children of regular employees of the Federal Government who are employed outside of the State, but who through law are permitted to retain their North Carolina citizenship.

The furnishing of incomplete or incorrect information regarding residence may result in the student's dismissal from college.

The Registration Office determines each student's residence status on the basis of existing information and interpretation of regulations. Appeals from such classification may be made to the Consolidated University Administration on forms obtainable from the Registration Office.

GRADES AND SCHOLARSHIP — — — — — — — — —

North Carolina State College operates on a credit-point system. Semester credits represent the number of hours of work completed; quality points are determined by the grades earned.

A	**Excellent**	**4 quality points for each credit hour.**
B	**Good**	**3 quality points for each credit hour.**
C	**Average**	**2 quality points for each credit hour.**
D	**Passing**	**1 quality point for each credit hour.**
F	**Failing**	**0 quality point for each credit hour.**
Inc.	**Incomplete**	
Abs.	**Absent from examination**	

EXPLANATIONS

At the discretion of the teacher, a student who has at least a C average in a course may be given an **incomplete** grade for work not completed because of a serious interruption in the student's work not caused by his own negligence. An incomplete grade must be made up during the next semester the student is in residence, unless the department involved is not able to allow the make-up. In this latter case, the department will notify the student and the Office of Registration when the incomplete must be made up. Any incomplete not removed during the period specified by the department will automatically become a failure and will be recorded as "Fi".

A grade of "Fa" is recorded for an unexcused absence from examination. If an absence from examination is excused, the student must take the examination during the next semester he is in residence or a grade of "Fa" will be recorded.

A grade of **"Fd"** is posted if a student has unofficially dropped a course for which he has been scheduled, or if he had officially dropped after the final date for dropping courses without failure. A failure may be made up only by repeating the subject. Such a repeat course must be regularly scheduled on the student's roster.

NOTE: Any student who fails a course within two semesters of graduation and who fails only one course during that semester may apply to the Office of Registration for permission to remove that failure by standing for reexamination on the total subject matter of the course.

If a senior fails more than one course during the semester and removes all but one of these deficiencies by repeating the course or courses, and if he has not had another reexamination, he may apply at the end of his last semester in residence for permission to take a reexamination.

When such a reexamination is taken to remove an "F", only the reexamination will be counted. And a senior who has passed a reexamination will have his grade for this course changed from "F" to "R", which is equivalent in quality points to a grade of "D". A fee of $5.00 will be charged for such a reexamination.

During the first two years of residence at this institution and the summer sessions immediately following (or until 65 semester hours have been earned in residence and/or by transfer), students may repeat courses passed for the purpose of improving their understanding of the basic subject matter. Such a repeat must be made in the next subsequent semester in which the course is offered. When a course is repeated, both grades will be considered in the college scholarship standards. Thereafter a student may repeat a course previously passed only by auditing the course. At the student's request, the teacher may allow an auditor full participation in all class activities. Courses audited will count the same as credit courses in computing a student's academic load, except for veteran benefits.

Students progress from one class to a higher class after they have completed the required number of hours for the higher classification. At the present time students are classified at the beginning of the fall semester and at no other time.

In addition to the thirty semester hours of earned credit and the 1.5 scholastic average, a student in the School of Engineering must have earned a minimum grade of "C" on MA 102 to be eligible to roster courses taught by the School of Engineering above the freshman level.

Freshman	1-29 semester hours of earned credit
Sophomore	30-64 semester hours of earned credit
Junior	65-99 semester hours of earned credit
Senior	100 or more semester hours of earned credit
Professional (School of Design)	140 or more semester hours

At the end of his freshman year, a student must have an over-all 1.5 average (1½ times as many quality points as total hours carried) to be eligible to continue. A freshman must meet this requirement by the end of the summer after he has completed two full semesters (not necessarily both in one school year or at this institution.)

At the end of his sophomore year, and each succeeding year, a student must have an over-all 2.0 average (twice as many quality points as total hours carried) to be eligible to continue. A student must meet this requirement for the first time by the end of the summer after he has completed four full semesters (not necessarily all in two school years). A transfer student (with or without credit) who has attended some other college as much as two semesters must meet this requirement the first summer after he completes two semesters at this institution. Credits and points transferred from other institutions are considered in the application of this rule.

Any student who falls below a 1.5 average for the work scheduled for any semester will be placed on scholastic probation, and will have his course load for the succeeding semester regulated by his Dean or Director of Instruction. A student is scholastically eligible for graduation when he has satisfied all the specific requirements of his department, the School, and the College, and has at least a C average, twice as many quality points as total credit hours taken.

Any student carrying 14 or more semester hours must pass at least 6 hours his first semester and 8 hours each semester thereafter. Students carrying less than 14 hours must pass at least half the work in order to continue.

TUITION AND FEES

Charges for tuition and fees vary according to (1) the student's status as a resident or non-resident of North Carolina at the time of his first enrollment; (2) type of student (regular undergraduates, special or unclassified undergraduate, auditor or graduate student); and (3) to a minor degree the curriculum in which the student is enrolled.

An application for admission must be accompanied by an application fee of $10. This fee is refunded to students whose applications are denied. It is forfeited by applicants who are accepted but who do not enroll.

Tuition and fees are payable in advance each semester, prior to registration day, upon receipt of a statement from the College Cashier (students desiring to do so may pay monthly installments.) All charges are subject to change without notice, but the charges in effect currently are as follows:

Regular Undergraduate Students:

School	In-State Students		Out-of-State Students	
	First Semester	Second Semester	First Semester	Second Semester
Agriculture	$149	$142	$326	$317
Design	148	142	323	317
Education:				
Agricultural Education	149	142	314	317
Others	146	140	321	315
Engineering	148	142	323	317
Forestry	158	142	333	317*
Textiles	148	142	323	317

*Add $10 if not registered in first semester.

Late Registration Fee—All students, graduate and undergraduate, who fail to register on dates scheduled must pay a $5.00 late registration fee.

Undergraduate Students Taking Less than 7 Hours:

Undergraduate students taking one course of not more than 4 hours during a regular semester will be charged one-fourth tuition, one-fourth academic fees and no non-academic fees. These students will not be entitled to any of the services and privileges provided by the non-academic fees. Undergraduate students taking 5 or 6 hours during a regular semester will be charged one-half tuition, one-half academic fees and all non-academic fees. All other undergraduate students will pay full tuition and fees.

Auditors:

Subject to academic regulations regularly enrolled undergraduate students may audit courses without additional charge. Those not regularly enrolled, or registering for audits only, will pay the rates applicable to undergraduate students.

Graduate Students:

Applicants interested in graduate work may receive a schedule of fees upon application to the Graduate School.

Commencement fee:

A fee of $9, covering cost of diploma and rental of cap and gown, is charged candidates for the baccalaureate degree during the last semester before the degree is awarded.

Deposits:

(a) As partial security for military uniforms, library books, laboratory equipment, etc., a general deposit of $20 is required to be paid by regularly enrolled undergraduate students at the time of their first enrollment (see also under "Refunds").

(b) Certain departments are allowed to collect small deposits in addition to the general deposit referred to above, for such things as room keys, lockers, etc. In such instances departmental regulations will apply.

Staff:

Full-time staff members may register for one course at a flat rate of $15 per semester. This payment does not include non-academic fees, and none of the privileges attendant upon the payment of such fees are allowed.

Audits:

Subject to academic regulations, regularly enrolled graduate or undergraduate students may audit courses by registering for them. The first audit will be disregarded in determination of course load on which tuition and fee payments are based, but any additional audits are to be added to the course load at full credit hour value. Students registered for audits only will pay the rates applicable to special or unclassified students. Full-time staff members may register for and audit one course per semester without charge.

Professional students in engineering:

Students in the various fifth-year professional curricula described on pages 130-131 of catalog will be charged on same basis as "Special and Unclassified Students."

Thesis preparation:

Graduate students who have completed course requirements and are in residence for thesis work only will be charged $15 per semester for tuition, plus all non-academic fees. Graduate students not in residence who have completed all requirements for the degree sought except for the thesis will be required to register for the term in which final requirements for the degree are to be completed and pay $15 tuition fee.

Degree Only:

Graduate Students who have completed all requirements for the degree sought are required to register for the term in which the degree will be awarded and pay a tuition fee of $10.

ROOM RENT

Rooms in the college dormitories rent for $85 per person per semester. In addition, the student must include with his remittance a deposit of $2 for his room and mail box keys. This deposit will be refunded when the keys are returned to the Dormitory Rental Office. Janitorial service is furnished but each student must provide his own linens, blankets and pillow. Dormitory room applications are for the period of a school year and the rent is payable in advance prior to the beginning of each semester as announced. When a new student is accepted by the college, he is sent a letter of clearance together with a dormitory room reservation request form. If he wishes to reserve a dormitory room, he should fill out the reservation request and return it with his remittance. Rooms will be assigned in the order in which payment of rent is received. Individual preferences as to location of room and/or choice of roommate will be complied with as far as possible. *All reservations are subject to published dormitory rules and regulations.* Male freshman students are required to live in the college dormitories unless living with parents or relatives.

BOARD

Meals are served cafeteria style, and the cost depends upon the individual student. Average cost would be approximately $500 per year.

BOOKS AND SUPPLIES

The cost for books and supplies is variable, depending upon the curriculum in which the student is enrolled. A reasonable estimate would be $75 per year, but students who have to buy drawing supplies and slide rules have an additional original outlay. All books and supplies are paid for in cash as purchased.

ESTIMATED ANNUAL COST

Total expenses of a full-time student from North Carolina, exclusive of clothing, pocket money, travel, and other incidentals, need not exceed $1,100. Out-of-state students will need an additional $350.

PAYMENT SCHEDULE

Tuition and fees are payable in advance each term, on registration day. Students desiring to do so may pay on an installment basis. A service charge of $2 per semester is made for this arrangement.

LATE REGISTRATION

Registration schedules are set for specific days, and certain definite procedures are outlined. A student has not completed registration until all the required steps are taken. All students, graduate and undergraduate, who fail to register on dates scheduled must pay a $5.00 late registration fee.

REFUNDS

TUITION AND FEES

A student who withdraws from school on or before the last day for registration will receive a refund of the full amount paid, less a $5 registration fee. On withdrawal later than the period specified, no refund will be made.

ROOM RENT

REFUND OF ROOM RENT will be made if reservation is cancelled:

a. PRIOR to the first day of the registration period, the rent paid will be refunded less the $10 reservation fee.
b. DURING the registration period, the rent paid will be refunded less the $10 reservation fee OR a charge of $1 per day (whichever amount is greater) from the first day of the registration period (or date of reservation, whichever is later) to date of cancellation.
c. AFTER the last day for registration, NO REFUND will be made for any reason other than WITHDRAWAL from College.

CANCELLATION OF RESERVATIONS MUST BE MADE IN PERSON OR IN WRITING TO THE SUPERVISOR OF DORMITORY RENTALS, ROOM 4, HOLLADAY HALL, N. C. STATE COLLEGE, RALEIGH, N. C.

GENERAL DEPOSIT

The general deposit is refunded when a student has completed the requirements for a degree or has dropped out of school. The student must apply to the Business Office for the refund. Refund will be made by check within 30 days after the application is received.

REFUND COMMITTEE

In some instances circumstances justify the waiving of rules regarding refunds. An example might be withdrawal from school because of illness. Students have the privilege of appeal to the Refund Committee when they feel that special consideration is merited. Applications for such appeals may be secured from the Division of Student Affairs.

STUDENT ACTIVITIES AND SERVICES

State College makes every effort to provide the student with surroundings which are pleasant and conducive to intellectual growth. Respecting the student as an individual, the college assures him the maximum of personal liberty within the limits necessary for orderly progression of class work and consistent with respect for the rights of others. In return, he is expected to pay serious attention to his purpose in attending college and to observe rules of conduct consistent with maturity. Through the various services and activities identified with everyday life on the campus, as well as through the several extracurricular organizations and functions, the student at State College has an excellent opportunity for acquiring experience in group leadership and community living which he may take with him into his professional career.

As the student progresses in his development, especially after his freshman year, he will find many opportunities to increase his growth in citizenship by participating in the activities of his academic class and of the student body in general. Following is a survey of the various activities at State College.

STUDENT GOVERNMENT AND HONOR SYSTEM

When he enters State College, the student becomes a member 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 over-all college Administration. The Student Government members and Judicial Department members are elected in campus-wide elections. The student has a voice in his own government by participating in these elections. Often in general elections he is asked to vote on proposed changes in regulations which affect the student body or on changes in the Student Government constitution.

The student also becomes part of an Honor System which expects him to adhere to its general aims: honesty in class work and honor in general conduct.

CLUBS AND SOCIETIES

Through the various honorary, professional and technical, and social organizations at State, the interested students find many opportunities to participate in activities that appeal to them and to meet others who have similar interests.

College Honorary

Golden Chain—Senior leadership
Blue Key—Junior leadership
Thirty-and-Three—Sophomore leadership
Phi Eta Sigma—Freshman scholarship
Phi Kappa Phi—Scholarship, Juniors, Seniors and Graduate Students

Professional and Technical

Each school at State College sponsors or supervises a large number of professional and technical societies and clubs. Students in every area of instruction are encouraged to join with their fellow students in pursuing their common interests. Many of these organizations contribute greatly to the student's professional and social growth.

Social Fraternities

Eighteen national social fraternities have chapters at State College. Each has two representatives on the Interfraternity Council, which has as its objectives promoting the general interests and welfare of the associated fraternities and insuring cooperation between them in their relations with the faculty, the student body and the public in general.

STUDENT PUBLICATIONS

State College has a large number and variety of publications, both general and School-sponsored, edited and managed by student officers, with faculty members serving as advisers. Any student who wishes to may gain journalistic experience and training in writing, editing or managing regular journals and annuals.

The three general publications, **The Agromeck, The Student Broadcasting System,** and **The Technician** are supported in large part by a publication fee, which is a part of each student's fees.

The Agromeck is the College Yearbook, providing a record of the classes and of the principal events of the school year. It recalls in pictures the varied activities of the student body throughout the year. **The Agromeck** is published for the entire student body under the sponsorship of the senior class.

Although it is not a "publication" in the strictest sense of the word **The Student Broadcasting System,** a carrier-current station with coverage limited to the campus, serves the same function through a different medium. It offers many opportunities for extra-curricular training in actual broadcasting techniques as well as training in administration and program planning.

The Technician is the student newspaper, issued twice a week and delivered to the dormitories and fraternity houses. Students living off campus receive their copies of the newspaper by mail. **The Technician** serves as a forum for student expression as well as a medium for news of particular interest to State College students. Each student receives a copy of **The Tower,** the College handbook, which contains detailed information about student regulations, organizations and activities.

Several of the Schools have their own publications, which are published under the general supervision of the particular School and deal with material of special interest to students in that School.

These publications include **The Agriculturist,** published by the School of Agriculture; **The Pi-ne-tum,** published by the School of Forestry; **The**

Southern Engineer, published by the School of Engineering; **The Textile Forum**, published by the School of Textiles; and the **Publications of the School of Design.**

ATHLETICS

In addition to voluntary programs of intramural and intercollegiate sports, State College requires freshmen and sophomores to enroll in credit courses in physical education.

INTRAMURAL

The college maintains an extensive program of intramural sports which is administered by the Department of Physical Education. Participation in these sports is purely voluntary; it does not receive college credit. Competition in thirteen sports is engaged in by dormitory and fraternity leagues.

Sports used in the intramural program are correlated with those used in the required class work in physical education. Instruction in the sports is given in the classes, and opportunity for competition is provided in the intramural program. Winners in these competitions are awarded cups, shields and trophies. An Intramural Advisory Board composed of representative students assists the director of the intramural program.

For intramural competition as well as for classes in physical education, Frank Thompson Gymnasium has a swimming pool, a large playing area for basketball, an auxiliary gymnasium with three handball courts, a room for wrestling, a locker room and showers. Several fields are provided for intramural and recreational play. Six semi-hard-surface and nine hard-surface courts are available for tennis, with additional courts contemplated. A new two million dollar gymnasium has been authorized and should be in use by 1960.

INTERCOLLEGIATE

Intercollegiate athletics at State College come under the supervision of a separate department of the college; policies governing intercollegiate competition are recommended, however, by the Athletic Council, composed of faculty, students and alumni, in full accord with Atlantic Coast Conference rules of eligibility for intercollegiate contests. Membership of the Atlantic Coast Conference comprises, in addition to State, Duke, Wake Forest, the University of North Carolina at Chapel Hill, Maryland, Clemson and South Carolina.

The program in intercollegiate athletics consists of the organization and training of "Wolfpack" teams in football, basketball, baseball, track, cross-country, wrestling, swimming, tennis, golf, soccer, fencing and rifle competition.

Facilities for intercollegiate athletics at State include Riddick Stadium, a 20,000-seat stadium for football; William Neal Reynolds Coliseum, a 12,000-seat arena for basketball; four football practice fields, 15 tennis courts, a 25-yard swimming pool in Frank Thompson Gymnasium; and facilities in the Coliseum for wrestling, fencing and other sports.

MUSIC

Since the early days of North Carolina State College its musical organizations have played an important place in the life of the campus. These groups present concerts, furnish music for official College functions and perform at athletic events.

The combined membership of these organizations constitutes the largest voluntary student organization on campus.

The Men's Glee Club performs several concerts each year both on and off the campus. In addition to these concerts this group makes appearances on television, radio, tours and provides small ensemble music for special occasions.

The Symphonic Band, The Fanfare Band, The Marching Band and the R.O.T.C. Band make up the four divisions of the N. C. State Bands. Each Band serves a specific purpose in the musical life of the campus. Assignments to the various Bands are made according to the interests and ability of the individual student.

The Symphonic and Fanfare Bands are concert organizations. Students who are unable to meet the rigid requirements for Symphonic Band are eligible to try for the Fanfare Band.

The Marching Band operates primarily during football season and is widely known for its spectacular half-time performances.

The R.O.T.C. Band consists of freshman and sophomore ROTC and AFROTC students. Participation in band eliminates the student from all ROTC drill on the field.

The Chapel Choir is a special group selected from the Glee Club which provides music for the weekly service in the Danforth Chapel.

The student who spends a great deal of time studying finds music to be a very stimulating activity. Participation in music helps the student maintain a healthy attitude toward college and toward life in general. Rehearsal schedules have been carefully arranged to avoid conflicts with other classes or with study time.

Additional information about music activities can be obtained by writing or visiting the Director of Music in Pullen Hall at any time.

STUDENT CENTERS

Students at State College find that a great deal of their extracurricular activity centers around two buildings, the College YMCA and the College Union. The YMCA has long served the College as a religious center. The College Union has provided State College students with entertainment and with opportunities and facilities for recreation and relaxation. The building offers to both students and faculty a variety of features. On the ground floor are a snack bar, a small dining room, game rooms, a barber shop and free telephones. The main floor has an assembly and ballroom, a library, lounges, a gallery area for exhibits, and facilities for two small dining rooms. The second floor contains the College Union offices, a photographic darkroom, guest rooms, a quiet room, a room for listening to music, a theatre, a workshop, meeting rooms, and student organization offices.

The College Union serves a great many purposes. Its most obvious function is to provide a center where students can have fun and meet their friends. Through its widely varied program, however, it serves a deeper function—by introducing the student to the art of leisure-time living and by providing opportunities for leadership. Further, the College Union provides a showcase where students may display their talent in the form of exhibits, workshops, and entertainment which they have produced. Each student is invited to work on one of the College Union committees and to take an active part in the Union program.

In addition to the functions and activities housed in the College Union Building, many other activities, especially those of a religious, spiritual and devotional nature, are sponsored by the State College YMCA and are held within its facilities. It offers to the students an attractive lobby equipped with writing and reading tables and comfortable chairs, a television room, and four conference rooms where student and faculty groups may meet.

The Danforth Chapel provides a place for religious services and meditation for all faiths.

The YMCA plans social events and lectures on various topics related to student life in addition to, or in connection with, its programs of religious emphasis.

LIBRARY

The D. H. Hill Library was designed to accommodate all the varied functions that a modern college library must perform. It provides shelves for

400,000 volumes, seats for 900 readers, private studies and conference rooms, and well-lighted, ventilated reading rooms. Ample book stacks are provided to accommodate a fast-growing book collection, facilities for photoprinting and micro-filming are available, and the service and reading areas of the library make a welcome and satisfactory working center for the students and faculty of the college.

The book collection itself strongly reflects the teaching and research requirements of State College—that is to say it is primarily scientific and technological. There is available, nevertheless, a fine and well-selected collection of books and materials on every phase of cultural interest as well as for recreational reading. At the present time the collection numbers over 180,000 volumes. Over 2,600 journals are received currently, and over 3,000,000 documents are held resulting from the depository status which the college library holds for publications of the Federal Government.

In the attractive lobby of the building there is arranged a collection of books for recreational reading. Students may explore this area as they please and check out the books of their choice. The big West Reading Room, colorful, well-lighted and interesting, is an invitation to study, and on the top floor is a special smaller study open to the students who prefer to work in a more secluded place. For the graduate students there are desks and private lockers in the stacks and adjoining the ground floor stacks, a large and pleasant room where faculty members and graduate students may work. In addition to these facilities, there are several conference rooms open to any college groups requesting them, and rooms which can be temporarily assigned to faculty members. The Library is a place for work, for acquiring technical knowledge; it can also be a place for discovering all the wealth of pleasure and of widened understanding which books can bring to the student who decides he does indeed desire to become a man of education and stature.

In addition to the D. H. Hill Library, specialized branch libraries are maintained in Textiles, Design, and the Biological Sciences.

HOUSING

At State, the dormitory is considered something more than merely a suitable place for living and studying. A well-organized dormitory program plays an important role in the student's all-around development. Under the program, each dormitory is organized much like a club, with officers elected by the residents, and paid student managers recommended by the dormitory officers and approved by the college. Each student is encouraged to participate in the athletic, social and recreational activities of his dormitory and in this way to have opportunity to meet and make friends with students of variant backgrounds, to use his leisure time pleasantly and profitably, and to grow in personality. Each dormitory elects its representatives to the Interdormitory Council, a student organization which coordinates interdormitory activities and programs. In each of eight major dormitories faculty couples occupy apartments and act as hosts and hostesses. They assist the occupants with their problems and provide a pleasant atmosphere in which the parents and friends of the occupants can visit the dormitory.

The College has no dormitory for women students. Co-eds must make their own housing arrangements. A list of available rooms for rent is maintained at the Dormitory Rental Office in Room 4, Holladay Hall.

For the married veteran, the college has 204 units equipped for family living located in Vetville. Vetville has its own community government with officers elected by the residents.

During the 1958-59 academic year, approximately 400 students are living in off-campus residences maintained by the eighteen social fraternities which have chapters at State College. Each chapter is represented in the Interfraternity Council, which sponsors athletic events and social functions of particular interest to fraternity members.

FOOD SERVICES

The State College student does not have to travel far for food, whether it is a full meal or a between-class snack.

Leazar Hall, the main dining hall, provides four cafeteria lines where the student may secure nutritious food at reasonable prices. The cafeteria will accommodate 1,600 people an hour.

The College Union building offers dining room facilities for groups and a snack bar. Shuttle Inn in the Textile Building serves sandwiches and grill items. Shuttle Inn is operated by the Student Supply Store.

In addition, each dormitory area has its own snack bar, also operated by the Student Supply Store system.

LAUNDRY AND DRY CLEANING

The college laundry provides on-campus laundry and dry-cleaning service on a cash-and-carry basis for both students and staff at inexpensive rates.

LINEN RENTAL SERVICE

This service provides for an initial issue of two (2) sheets, one (1) pillow case and three (3) towels and a complete change each week during the school year. A student availing himself of this service need not purchase or bring these items with him when he comes to enter school. The service is available to all students at a cost of $22.50 per school year. Applications for this service are mailed with Dormitory Room Reservation forms, or they may be obtained from the Dormitory Rental Office.

BARBER SERVICE

Two barber shops are provided, one in the YMCA Building and one in the College Union.

BOOKS AND SUPPLIES

Watauga Book Shop. All required textbooks and other books of current and permanent interest can be purchased in Watauga Book Shop, housed in the basement of Watauga Hall.

Book Exchange. Alpha Zeta, student honor fraternity, maintains a book exchange in College Union where students may exchange or sell used books.

General Supplies. The Student Supply Store, located in the basement of the YMCA Building, stocks a wide variety of general items which the student will need, including drawing instruments, writing supplies and incidentals.

HEALTH

The college seeks to safeguard the health of the student in every way possible. It maintains a 76-bed infirmary, open 24 hours a day, with a staff of fifteen: two college physicians, a supervising nurse, a night supervisor, six general duty nurses, one full-time laboratory and X-ray technician, and four other personnel. Among the many valuable features of the infirmary are an up-to-date first aid department and X-ray department.

The college physicians observe regular daily office hours in the infirmary, in the mornings and afternoons. In addition, they visit the infirmary more often when necessary. A graduate nurse is on duty day and night. Students have free access to the infirmary at all times.

In case of accident or serious illness of a student, parents or guardians will be notified immediately. No surgical operation will be performed without full consent of parents or guardians, except in cases of extreme emergency.

The medical fee which each student pays provides for infirmary service, general medical treatment, and for the services of nurses. It does not provide for surgical operations, outside hospital care, or the services of dentists or other specialists.

Before the student enters college he should have a complete, thorough examination by his family physician. Any abnormality should be noted and

all remedial defects corrected in order to prevent unnecessary loss of time while the student is in college. If the examination is not done before he enters, the student will be given a physical examination at the college, for which a fee is charged. Blanks for the physical examination can be secured from the Office of Admissions and Registration.

The college offers annually a plan of student accident and health insurance. The insurance is planned to cover the surgical, accident and hospital needs of the student supplementing the services of the infirmary. Each year complete information will be furnished students before the opening of school.

ORIENTATION

Several days before the registration of upperclassmen in the fall semester, new students arrive on the campus for a series of activities known as Orientation Week. To help freshmen with the transition from high school to college and to help new students become acquainted with the campus and with college regulations, the College arranges during this period a series of meetings and conferences with faculty and student leaders.

Throughout the first semester, there are other activities designed to continue orientation and to supplement orientation courses conducted by the individual schools. In addition, the individual schools provide for regular contact with faculty advisers so that each student has the opportunity for discussing matters connected with his adjustment to college life.

COUNSELING: STUDENT QUESTIONS AND PROBLEMS

General. The general information center for students at State College is located in Holladay Hall and includes the offices of the Dean of Student Affairs and of administrators handling admissions, registration, records, attendance, student activities, student housing, orientation and counseling, and student financial aid.

Academic. Upon enrolling at State College, each student is assigned a faculty adviser, usually a member of the department in which the student is taking his major work. This faculty adviser works with the student in planning his program of studies and is available for other help in solving problems of an academic nature. The deans, directors of instruction, and department heads are also available to the student to help him get information about the different curricula and to help him think through his educational plans. Teachers of courses in which the student is enrolled are the best sources of help with particular subjects. Members of the teaching staff maintain a schedule of office hours and expect the student to consult them individually wherever special help is needed.

Dormitory Counseling. Each of the dormitories at State College has a building manager, an upperclassman with the qualifications for, and responsibility of, helping individual students in his dormitory, particularly freshmen, in any way he can. Floor managers and assistant floor managers chosen on the same basis, assist the dormitory manager. Whenever these managers cannot answer particular questions or give aid in solving special problems, they direct the student to the administrative official who can. Also, in the larger dormitories, faculty couples are quartered, to provide the influence and assistance that such mature persons can give.

Financial Problems. The services of the Student Financial Aid Office are discussed in the next section.

Counseling Center. The State College Counseling Center is located on the 2nd floor of Holladay Hall. Counseling with respect to vocational and curricular choice, problems of adjustment to college life, and various personal problems, is available at the Center. Students may be referred by teachers, advisers and others of the college staff, or they may come on their own initiative. Psychological tests, information concerning various occupations, and other aids are used in helping students. Referral can be made for students desiring remedial work in speech, reading, and other special areas.

Placement. Each of the degree-granting Schools at State College provides its students with assistance in obtaining employment during summer vacation and upon graduation. In some curricula a period of approved summer work is required for graduation.

FINANCIAL AID

Help in meeting college expenses is available to State College students in several forms: scholarships, grants-in-aid, loans, athletic awards, deferred payments on tuition and fees, part-time jobs.

Financial aid is administered by the Student Financial Aid Officer under the general direction of the College Committee on Scholarships and Student Aid. Students seeking information or counseling on financial matters, or wishing to apply for assistance, should write or come to the Student Financial Aid Office at 207 Holladay Hall.

Scholarships include those which are available generally, without regard to curriculum, and those restricted to the students of particular schools or departments. They include awards available to entering students and those available to upperclassmen.

Grants-in-aid are small scholarships, normally not exceeding $200.00 per student per year, awarded with financial need as the main consideration.

Loans are made on a long-term, low-interest basis to deserving students, ordinarily with the understanding that repayment will be made after the student leaves the college permanently. Usually such loans do not exceed $300.00 per student per year. Short-term emergency loans, generally not exceeding $50.00, are also available.

Athletic Awards are made upon the recommendation of the Athletic Department to athletes who meet the established qualifications for such awards.

A Part-time Employment Service is provided, to assist students in locating jobs both on and off campus.

Periodically, the Scholarship and Student Aid Committee publishes a full listing of scholarships and awards available both to entering freshmen and to upperclassmen. Copies of these listings may be secured from the Student Financial Aid Office.

FELLOWSHIPS AND GRADUATE ASSISTANTSHIPS

Graduate fellowships are funds offered to graduate students to assist in the support of programs of advanced study. Holders of fellowships have no obligations to the college and may devote full time to the prosecution of their graduate programs. Funds for these fellowships are provided by various professional groups and business organizations. Applicants for fellowships should contact the head of the department in which they wish to pursue studies.

Graduate assistantships are short-term staff appointments that carry stipends ranging from $1200 to $4800 depending upon the magnitude of the service obligation and the experience of the appointee. **Teaching assistants** are customarily appointed annually for the nine months academic year. **Research assistants** are often appointed on a calendar year basis and, accordingly, stipends may be 20 per cent larger than those for teaching assistants. Only graduate students in good-standing are eligible for appointment to graduate assistantships. The course loads permitted graduate assistants are adjusted in proportion to the service obligation. Graduate assistants giving half time to their service obligation may register for 60 per cent of a full course load.

. . . the two supreme temporal needs of North Carolina today are (1) a race of farmers so intelligent, so thrifty, so capably fitted that it can win from the soil a more adequate return for its labors and thereby add to its comfort and education and wealth of the State. . . .

. . . and (2) a specifically educated class of men who can turn our raw products into more highly organized wares and who can skillfully and unhesitatingly lead the industrial progress of our people To contribute more and more each year to the rearing of such men is the mission of our college.

Daniel Harvey Hill
President, 1908-1916



← D. H. HILL LIBRARY

III. PROGRAMS OF STUDY

BY SCHOOLS

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SCHOOL OF AGRICULTURE

D. W. Colvard, Dean

H. B. James, Director of Instruction

INTRODUCTORY

The agriculture of our modern world is more than growing food and fibre. It includes all of the technical, professional and business occupations connected with the processing and distribution of farm products.

The men who produce and supply the farmer with his complex needs, the farmer himself, those to whom he sells, the processor of these products, and the retailer—all these are part of today's agriculture.

All told they add up to nearly 40 per cent of the 65 million employed people in the United States—making agriculture the nation's biggest single industry. There are more than 500 distinct occupations in today's agriculture—jobs that each year need more than twice the number of people trained to fill them.

This new concept of agriculture is defined to include three important groups in our economy. The first is the farmers themselves—those who are engaged in the production of crops and livestock. The second includes those industries which furnish supplies and services to farmers; the third includes those industries which process, store, handle and merchandise farm products.

The overall objective of the School of Agriculture is the development of well-rounded, educated citizens capable of assuming important roles in business, science and technology as they relate to farming and associated industries.

FACILITIES

A sound teaching and research program is based on taking advantage of the most modern equipment available in each field. North Carolina State is fortunate to have at its disposal the newest equipment and facilities in many fields.

Laboratories are well equipped with the necessary materials for learning and practicing the basic and applied sciences. Machinery and equipment, in some cases provided by private industry, keep students abreast of the latest technological advances. Extensive plant, animal and insect collections are available for use in teaching and for research.

The D. H. Hill Library at N. C. State has a large collection of scientific books and periodicals which provide excellent source material for many courses. In addition, students may draw from the specialized periodicals and textbooks located in the Departmental Libraries.

North Carolina State's seventeen outlying research farms provide a practical classroom for many courses, as well as a place where researchers can carry on basic and applied research.

STUDENT ACTIVITIES

Students in the School of Agriculture have ample opportunities to take part in many broadening extra-curricular activities, both within the school and in the college itself.

Most departments have student organizations which provide professional as well as social experience. Student tours provide an opportunity to see first-hand the application of classroom principles.

In addition, judging teams representing Animal Industry, Horticulture and Poultry, compete regionally and nationally, giving student members a chance to travel while learning more about their field.

CURRICULAR OFFERINGS AND REQUIREMENTS

The modern concept of agriculture has given North Carolina State College's oldest school its newest look. A freshman enrolling in the School of Agriculture now chooses from three curricula—Agricultural Business, Agricultural Science, or Agricultural Technology—devised to more closely parallel the new concept.

After completing the first two years, consisting largely of basic courses in the biological, physical and social sciences, the student can choose his major from among the thirty-four offered by the School.

The student's needs for learning "how to make a living" and for learning "how to live" are both given consideration in the three curricula. Not only does each student get the solid background in science so necessary for today's agriculture, he has a chance to develop a program to fit his individual needs and wants.

Although requirements vary in the curricula, students in all three get a solid background in the sciences, plus a variety of electives. All the curricula have requirements in English and modern languages, the social sciences and humanities, and the physical and biological sciences. In addition, electives can be chosen from several specified areas (see curricula listings below), depending on the curriculum. The student will also have departmental requirements and electives in his major field.

In general, requirements are similar no matter which curriculum the student chooses. However, the program in **Science** places more emphasis on the physical and biological sciences, while that in **Business** emphasizes economics and business management, and the course in **Technology** is stronger in the applied science and technology courses. In some cases, a student may take the same major in any of the three curricula, depending on his interests and objectives.

The majors offered in the three curricula are:

Agricultural Business—Agricultural Economics, Animal Husbandry, Dairy Manufacturing, Dairy Husbandry, Field Crops, Horticulture, Poultry Science, Soils.

Agricultural Science—Agricultural Economics, Agricultural Engineering (joint program with the School of Engineering), Animal Husbandry, Botany, Chemistry, Dairy Manufacturing, Dairy Husbandry, Entomology, Experimental Statistics, Field Crops, Horticulture, Poultry Science, Rural Sociology, Soils, Wildlife Biology, Zoology. Pre-Veterinary work is also taken in this curriculum.

Agricultural Technology—Agricultural Economics, Agricultural Engineering, Animal Husbandry, Dairy Manufacturing, Dairy Husbandry, Field Crops, Horticulture, Plant Protection, Poultry Science, Soils.

DEGREES

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

The degrees of Master of Science, Master of Agriculture and professional degrees are offered in the various departments of the School of Agriculture after the satisfactory completion of at least one year of graduate study in residence.

The Doctor of Philosophy degree is offered by the following departments: Agricultural Economics, Agricultural Engineering, Animal Industry, Experimental Statistics, Field Crops, Botany, Entomology, Genetics, Plant Pathology, Soils and Zoology.

Further information may be found in the Graduate School Catalog.

OPPORTUNITIES

Agriculture is a broad field with fascinating new opportunities. It needs trained persons to process and distribute agricultural products, to give

special services to people who actually produce these products, and to do research and teaching that will make our agricultural production and distribution even more efficient.

The eight major fields of agriculture—research, industry, business, education, communications, conservation, services, as well as farming and ranching—need 15,000 college graduates each year in the United States. But at present, our colleges are graduating only about 7,000 a year trained for these jobs. This leaves more than two jobs for each graduate.

In North Carolina alone, there is a desperate need for college-trained people to farm their own land, and for well-schooled specialists in the fertilizer, dairy, feed, insecticide, farm implement and distribution industries. These industries put graduates in key positions and call for more than State College can supply.

Some of the opportunities in the eight major fields of agriculture are:

Research—production, marketing, engineering, processing, conservation, reclamation, etc.

Industry—machinery and equipment, chemicals, food processing, grain and seed processing, meat and poultry packing, etc.

Business—banking and credit, insurance, farm management, land appraisal, marketing, transportation, etc.

Education—vocational agriculture, agricultural extension, college instruction, governmental agencies, etc.

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

Conservation—soil, water, range, forest, fish, wildlife, parks, turf, etc.

Services—Inspection and regulation, production field service, quality control and grading, agricultural technicians and consultants, etc.

Farming and Ranching—general, dairy, swine, beef, sheep, poultry, cotton, forage, grain, fruits, tobacco, etc.

Practically all types of occupations—over 500 of them—are available to a graduate in agriculture. There are many opportunities in technology, science and business. The School of Agriculture stands ready to help meet the challenge of the new concept of agriculture with forward-looking curricula.

CURRICULA IN THE SCHOOL OF AGRICULTURE — — — —

CURRICULUM IN AGRICULTURAL BUSINESS

		Credits
AG 103	Introduction to Agriculture	1

Languages (12 Credits)

ENG 111, 112	English Composition	6
ENG 231	Basic Speaking Skills	3
Elective	(English or Modern Languages)	3

Social Science and Humanities (21 Credits)

EC 201	Economics	3
AGC 212	Economics of Agriculture	3
HI 261	The United States in Western Civilization	3
PS 201	The American Governmental System	3
PSY 200	Introduction to Psychology	3
RS 301	Sociology of Rural Life	3
Elective from Group D		3

Physical and Biological Sciences (24 Credits)

MA 111, 112	Algebra and Trigonometry, Analytic Geometry and Calculus A	8
CH 101	General Inorganic Chemistry	4
PY 211	General Physics	4
BO 103	General Botany	4
ZO 103	General Zoology	4

*Electives (68 Credits)**

Restricted electives from Group B	24
Restricted electives from Groups A and C	6
Departmental requirements and electives	26
Free electives	12
Sub-total	126
PE 101, 102, 201, 202 Physical Education	4
MS 101, 102, 201, 202 Military Science I and II, or AS 121, 122, 221, 222 Air Science I and II	8
Total	138

* 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. A listing of the courses in each group can be obtained by writing the Director of Instruction, School of Agriculture, N. C. State College, Raleigh, North Carolina.

CURRICULUM IN AGRICULTURAL SCIENCE

		Credits
AG 103	Introduction to Agriculture	1

Languages (12 Credits)

ENG 111, 112	English Composition	6
Electives	(English or Modern Languages)	6

Social Science and Humanities (21 Credits)

Electives from Group D	21

Physical and Biological Sciences (28 Credits)

MA 101, 102	First Year Math for Engineers, or	
MA 111, 112	Algebra and Trigonometry, Analytic Geometry and Calculus A	8-9
CH 101, 103	General Inorganic and Qualitative Chemistry, or	
CH 201, 203	General Inorganic and Organic Chemistry	8-9
PY 211	General Physics, or	
PY 201	General Physics	4
BO 103	General Botany	4
ZO 103	General Zoology	4

*Electives (64 Credits)**

Restricted electives from Group A**		26
Departmental requirements and electives		26
Free electives		12
	Sub-total	126
PE 101, 102, 201, 202	Physical Education	4
MS 101, 102, 201, 202	Military Science I and II, or	
AS 121, 122, 221, 222	Air Science I and II	8
	Total	138

* 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. A listing of the courses in each group can be obtained by writing the Director of Instruction, School of Agriculture, N. C. State College, Raleigh, North Carolina.

** Six credits may be elected from Groups B and C. Social Science majors may select from Group D.

CURRICULUM IN AGRICULTURAL TECHNOLOGY

		Credits
AG 103	Introduction to Agriculture	1

Languages (12 Credits)

ENG 111, 112	English Composition	6
ENG 231	Basic Speaking Skills	3
Elective	(English or Modern Languages)	3

Social Science and Humanities (21 Credits)

EC 201	Economics	3
AGC 212	Economics of Agriculture	3
HI 261	The United States in Western Civilization	3
PS 201	The American Governmental System	3
RS 301	Sociology of Rural Life	3
Electives from Group D		6

Physical and Biological Sciences (32 Credits)

MA 101, 102	First Year Math for Engineers, or	
MA 111, 112	Algebra and Trigonometry, Analytic Geometry and Calculus A	8-9
CH 101	General Inorganic Chemistry	4
CH 103	General and Qualitative Chemistry, or	
CH 203	General and Organic Chemistry	4
PY 211	General Physics	4
BO 103	General Botany	4
ZO 103	General Zoology	4
SOI 200	Soils**	4

*Electives (60 Credits)**

Restricted electives from Groups A and B		9-12
Restricted electives from Group C		9-12
Departmental requirements and electives		27
Free electives		12
	Sub-total	126

PE 101, 102, 201, 202	Physical Education	4
MS 101, 102, 201, 202	Military Science I and II, or	
AS 121, 122, 221, 222	Air Science I and II	8
	Total	138

* 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. A listing of the courses in each group can be obtained by writing the Director of Instruction, School of Agriculture, N. C. State College, Raleigh, North Carolina.

** Upon approval by the Director of Instruction, Geology 120 may be substituted for Soils.

AGRICULTURAL ECONOMICS

Patterson Hall

Professor C. E. BISHOP, *Head of the Department*
Professors H. BROOKS JAMES, RICHARD A. KING, JAMES G. MADDOX, WALTER H. PIERCE, GEORGE S. TOLLEY
Associate Professors ARTHUR J. COUTU, QUENTIN W. LINDSEY, WILLIAM D. TOUSSAINT, JAMES C. WILLIAMSON, JR.
Visiting Professor GEORGE MORTON
Assistant Professors WILLIAM R. HENRY, JAMES A. SEAGRAVES, ANTHONY P. STEMBERGER, RICHARD L. SIMMONS
Instructor WALTER L. FISHEL

OBJECTIVES

Students in Agricultural Economics are given training in the economic aspects of operating agricultural businesses. These Businesses include the three broad areas defined in the new concept of agriculture—farmers, industries which process, store, handle and merchandise agricultural products, and those which furnish supplies and services to agriculture.

Emphasis is also placed upon consumption of farm products and how changes in consumption affect decisions of producers and processors.

A sound foundation in basic economic principles is provided so that the graduate will be able to deal with the rapid changes in the techniques of agricultural production and marketing.

The general objectives of the department are: (1) to train students to make sound decisions in organizing and managing farms and other agricultural businesses; (2) to train students in the fundamentals of business organization; (3) to provide an understanding of the relation of agriculture to other parts of the economy, and how to evaluate agricultural policy and economic changes which affect agriculture; and (4) to train graduate students in advanced economic theory and research techniques.

OPPORTUNITIES

Training in Agricultural Economics qualifies a student for a wide range of opportunities. Many graduates of the department are employed in research and education work by various agencies of the federal and state governments. These agencies include the Agricultural Extension Service, the Agricultural Experiment Station, the State Department of Agriculture and various agencies of the United States Department of Agriculture.

The growing number of companies processing and manufacturing agricultural products has created an increasing demand for people trained in agricultural economics. Opportunities here 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 commercial banks.

Openings in all of these areas greatly exceed the number of graduates trained to fill them. And as the industrial and agricultural development of the region continues, employment opportunities are expected to increase.

CURRICULA

Undergraduate

The degree of Bachelor of Science with a major in Agricultural Economics may be earned under any of the three general curricula in the School of Agriculture.

Agricultural Business. In addition to the requirements of the Agricultural Business curriculum, the following courses are required:

Group B Courses (24 Credits)

		Credits
EC 302	National Income and Economic Welfare	3
EC 401	Principles of Accounting	3
EC 407	Business Law I	3
AGC 521	Economics of Agricultural Marketing, or	
AGC 523	Farm Management II	3
	Electives	12

Group A and C Courses (6 Credits)

CH 103	General and Qualitative Chemistry, or	
CH 203	General and Organic Chemistry	4
	Electives	2

Departmental Requirements and Electives (26 Credits)

AGC 303	Farm Management I	3
ST 311	Introduction to Statistics	3
AGC 533	Agricultural Policy	3
AGC 521	Economics of Agricultural Marketing	3
AGC 523	Farm Management II	3
	Electives	11

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

MA 211 and 212	Analytic Geometry and Calculus B, C, or	
MA 201 and 202	Calculus I and Calculus II	6 or 8
	Electives*	18 or 20

Departmental Requirements and Electives (26 Credits)

AGC 303	Farm Management I	3
AGC 311	Marketing Agricultural Products, or equivalent	3
ST 311	Introduction to Statistics	3
EC 401	Principles of Accounting	3
AGC 533	Agricultural Policy	3
AGC 551	Agricultural Production Economics	3
AGC 552	Consumption, Distribution and Prices in Agriculture	3
	Electives	5

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum the following courses are required:

Group A and B Courses (9-12 Credits)

		Credits
AGC 521 AGC 523	Economics of Agricultural Marketing, or Farm Management II	3
	Electives	6-9

Group C Courses (9-12 Credits)

	Electives	9-12

Departmental Requirements and Electives (26 Credits)

AGC 303	Farm Management I	3
AGC 311	Marketing Agricultural Products	3
ST 311	Introduction to Statistics	3
EC 401	Principles of Accounting	3
AGC 533	Agricultural Policy	3
AGC 551	Agricultural Production Economics	3
AGC 552	Consumption, Distribution and Prices in Agriculture	3
	Electives	5
		12

* **Six Credits may be elected from Groups B and C. Additional electives may be chosen from Group D.**

Graduate

The Department of Agricultural Economics offers programs of study leading to the Master of Agricultural Economics, the Master of Science and the Doctor of Philosophy degrees.

Special emphasis is placed on the economics of agricultural production and marketing, analysis of programs and policies affecting agriculture, and statistical techniques which can be used in solving agricultural problems.

AGRICULTURAL ENGINEERING

Agricultural Engineering Building

Professor G. WALLACE GILES, *Head of the Department*
Professors J. M. FORE, F. J. HASSLER, DAVID S. WEAVER, JOHN W. WEAVER, JR.
Associate Professors H. D. BOWEN, JAN VAN SCHILFGAARDE, W. E. SPLINTER
Assistant Professors GEORGE B. BLUM, JR., EZRA L. HOWELL, K. A. JORDON, W. T. MILLS, N. W. WELDON
Instructors E. O. BEASLEY, J. F. BEEMAN, THOMAS H. GARNER, W. H. JOHNSON, REX B. SPRINGSTON, C. W. SUGGS, J. I. SEWELL, J. D. TRAYWICK, R. W. WATKINS, EDWARD H. WISER
Head Mechanic RALPH B. GREENE

OBJECTIVES

Students in Agricultural Engineering are educated and trained to deal with the problems of agriculture that are engineering in nature. Involved are the application of scientific and engineering principles 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.

The need for men to carry out the technical aspects such as development and research as well as less technical work, such as sales and service of farm equipment, requires the offering of two distinct curricula as described below.

OPPORTUNITIES

Men trained in Agricultural Engineering under 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. The curriculum also provides adequate training for postgraduate work leading to advanced degrees.

Men trained in the field of 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

Undergraduate

Agricultural Science. This curriculum, offered in conjunction with the School of Engineering, is designed to develop young men capable of engineering, is designed to develop young men 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 Agricultural Engineering are directed to those methods of thought and techniques whereby science can be applied with understanding and judgement to engineering situations in agricultural operations. General agriculture courses are provided so that the student can better understand the agricultural industry with which he deals.

Since Agricultural Engineering involves two distinct technical fields—agriculture and engineering—this curriculum is a joint responsibility of the two schools and is so administered.

Yearly Courses in Agricultural Engineering

FRESHMAN

		Credits
ENG 111, 112	English Composition	6
MA 101, 102	First Year Math for Engineers	9
AG 101	Introduction to Agriculture	1
CH 101	General Inorganic Chemistry	4
AGE 151, 152	Farm Mechanics	4
ME 101, 102	Engineering Graphics I, II	4
MS 101, 102	Military Science, or	
AS 121, 122	Air Science	4
PE 101, 102	Physical Education	2
		34

SOPHOMORE

EM 311	Mechanics I	3
CH 203	General and Organic Chemistry	4
CE 201	Surveying I	3
AGE 211	Farm Power and Machinery	3
MA 201, 202	Calculus I, II	8
PY 201, 202	General Physics	10
MS 201, 202	Military Science, or	
AS 221, 222	Air Science	4
PE 201, 202	Physical Education	2
		37

JUNIOR

HI 261	The United States in Western Civilization	3
EC 201	Economics	3
EE 320	Elements of Electrical Engineering	4
EM 312	Mechanics II	3
EM 321	Strength of Materials I	3
EM 430	Fluid Mechanics	2
ENG 231	Basic Speaking Skills	3
ME 301	Engineering Thermodynamics I	3
MA 401	Differential Equations	3
SOI 200	Soils	4
	English Elective	3
	Electives	6
		40

SENIOR

BO 103	General Botany	4
AGC 212	Economics of Agriculture	3
AGE 371	Soil and Water Conservation Engineering	4
AGE 451	Curing and Drying of Farm Crops	2
AGE 452	Senior Seminar	1
AGE 462	Farm Power and Machinery IIA	4
AGE 481	Farm Structures	4
AGE 491	Rural Electrification	4
AGE 552	Instrumentation for Agricultural Research and Processing	1
PS 201	The American Governmental System	3
RS 301	Sociology of Rural Life	3
	Humanities Elective	3
	Electives	6
		42

ST 361, Introduction to Statistics for Engineers, and PY 407, Introduction to Modern Physics, are recommended for electives.

Agricultural Technology. This curriculum is less technical than the Agricultural Engineering curriculum. It is designed for those who are working on a practical level with farm people. Graduates are equipped to apply to the farm the new technology as developed and revealed by the technical engineer. The courses are presented mainly from the viewpoint of the user and consumer.

In addition to the requirements of the Agricultural Techonology curriculum, the following courses are required:

Group A and B Courses (11 Credits)

		Credits
MA 201	Calculus I	4
PY 212	General Physics	4
	Electives	3

Group C Courses (10 Credits)

EM 341	Mechanics (Statics) A		2
EM 342	Mechanics (Dynamics) B		2
AI 201	Elementary Dairy Science	)	
AI 202	Fundamentals of Animal Husbandry	)	
FC 211	Field Crops I	)	
FC 312	Pastures and Forage Crops	)	6
FC 414	Weeds and Their Control	)	
HRT 222	Introduction to Horticulture	)	
PO 201	Poultry Production	)	

Departmental Requirements and Electives (27 Credits)

AGE 151, 152	Farm Mechanics	4
AGE 211	Farm Power and Machinery	3
AGE 321	Irrigation, Terracing and Drainage	3
AGE 411	Farm Power and Machinery IIB	3
AGE 332	Farm Buildings and Crop Processing	3
AGE 341	Farm Electrification and Utilities	3
AGE 452	Seminar	1
ME 101, 102	Engineering Graphics I, II	4
CE 201	Survey I	3

The following courses, listed as optional in the basic Agricultural Technology curriculum, are required:

MA 101, 102	First year Math for Engineers
CH 203	General and Organic Chemistry

Graduate

The Department of Agricultural Engineering offers advanced study leading to the Ph.D. degree in any one of five fields of specialization. Power and Machinery, Rural Structures, Soil and Water Conservation, Rural Electrification, or Agricultural Processing.

The Master of Science program in Agricultural Engineering provides a broad background in science and engineering through advanced study in mathematics and physics.

For those individuals interested primarily in existing technology, a program of study for the Master of Agricultural Engineering degree permits selections from a variety of advance application courses. This program provides training appropriate for those engaged in the dissemination of information either as extension workers with public institutions or service representatives for industry. It is not intended as preliminary study to the Ph.D. degree.

AGRONOMY

See FIELD CROPS AND SOILS

ANIMAL INDUSTRY

Polk Hall

Professor GEORGE HYATT, JR., *Head of the Department*
Professors E. R. BARRICK, E. G. BATTE, J. L. ETCHELLS, F. M. HAIG, J. E. LEGATES, GENNARD MATRONE, J. C. OSBORNE, W. M. ROBERTS, M. L. SPECK, W. E. THOMAS, G. H. WISE.
Associate Professors L. W. AURAND, T. N. BLUMER, W. R. MURLEY, R. B. REDFERN, F. H. SMITH, S. B. TOVE, L. C. ULBERG, F. G. WARREN.
Assistant Professors A. J. CLAWSON, E. U. DILLARD, LEMUEL GOODE, J. J. MCNEILL, R. D. MOCHRIE, J. L. MOORE, R. M. MYERS, H. A. RAMSEY, W. W. G. SMART, JR., M. B. WISE.
Instructors H. B. CRAIG, G. L. ELLIS, C. G. WILKES, J. H. GREGORY, J. M. LEATHERWOOD, E. A. ZURAW.

OBJECTIVES

The Department of Animal Industry has the responsibility for training students in the field of dairy and livestock production and processing. To accomplish this aim, the department offers three majors—Animal Husbandry, Dairy Husbandry and Dairy Manufacturing—in each of the three curricula in the School of Agriculture.

Because of the new and broadened concept of agriculture, more job opportunities are provided in Animal Industry for students of varying backgrounds. Farm experience is beneficial for certain fields of Animal Industry; however, it is not essential for others. Members of the staff of the Department of Animal Industry will be glad to assist in planning summer work programs for students.

Plans have been initiated to offer within the next two years, an undergraduate program for a major in animal Nutrition in the Agricultural Science Curriculum.

OPPORTUNITIES

There are many and varied opportunities for students who major in any of the Animal Industry programs to enter the production, processing and marketing fields. The main opportunities in each major are:

Animal Husbandry—Agricultural extension and other educational work, feed consulting and sales work, livestock management, livestock breed promotion, livestock equipment sales, meat packing and processing, animal by-product manufacture and distribution, research and development, marketing livestock and livestock products, animal nutrition and animal breeding.

Dairy Husbandry—Agricultural extension and other educational work, feed consulting and sales work, dairy herd management, dairy breed promotion, dairy equipment sales, research and development, marketing dairy cattle and dairy products, dairy field work, dairy cattle nutrition and dairy cattle breeding.

Dairy Manufacturing—Dairy products sales, procurement of dairy products, processing dairy products, dairy plant management, dairy plant accounting, dairy supplies and equipment sales, quality control of dairy products, government (state or federal) inspection and control of dairy products and dairy products research and development.

CURRICULA

Undergraduate—Animal Husbandry

The degree of Bachelor of Science with a major in Animal Husbandry may be obtained under any of the three curricula offered by the School of Agriculture.

Agricultural Business. In addition to the requirements of the Agricultural Business curriculum, the following courses are required:

Group B Courses (24 Credits)

		Credits
	Electives	24

Group A Courses (6 Credits)

CH 451	Introductory Biochemistry	3
ZO 301	Animal Physiology	3

Departmental Requirements and Electives (26 Credits)

AI 202	Fundamentals of Animal Husbandry	4
AI 303	Meat and Meat Products	3
AI 312	Principles of Livestock Nutrition	3
AI 406	Animal Industry Seminar	1
CH 203	General and Organic Chemistry	4
BO 312	General Bacteriology	4
GN 411	The Principles of Genetics	3
One of the following:		
AI 401	Beef Cattle Production	
AI 402	Sheep Production	
AI 403	Pork Production	3
	Elective	1

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

BO 312	General Bacteriology	4
CH 451	Introductory Biochemistry	3
ZO 301	Animal Physiology	3
GN 411	The Principles of Genetics	3
	Electives*	13

* Six credits may be elected from Groups B and C.

Departmental Requirements and Electives (26 Credits)

		Credits
AI 202	Fundamentals of Animal Husbandry	4
AI 303	Meat and Meat Products	3
AI 312	Principles of Livestock Nutrition	3
AI 406	Animal Industry Seminar	1
AI 502	Reproduction and Lactation	4
AI 503	Animal Breeding	3
AI 505	Animal Diseases	3
One of the following:		
AI 401	Beef Cattle Production	
AI 402	Sheep Production	
AI 403	Pork Production	3
	Elective	2

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum, the following courses are required:

Group A and B Courses (10 Credits)

BO 312	General Bacteriology	4
CH 451	Introductory Biochemistry	3
ZO 301	Animal Physiology	3

Group C Courses (11 Credits)

	Electives	11

Departmental Requirements and Electives (27 Credits)

AI 202	Fundamentals of Animal Husbandry	4
AI 301	Grading and Selecting Meat Animals	2
AI 303	Meat and Meat Products	3
AI 312	Principles of Livestock Nutrition	3
AI 406	Animal Industry Seminar	1
AI 503	Animal Breeding	3
CH 203	General and Organic Chemistry	4
GN 411	The Principles of Genetics	3
One of the following:		
AI 401	Beef Cattle Production	
AI 402	Sheep Production	
AI 403	Pork Production	3
	Elective	1

Undergraduate—Dairy Husbandry

The degree of Bachelor of Science with a major in Dairy Husbandry may be obtained under any of the three curricula offered by the School of Agriculture.

Agricultural Business. In addition to the requirements of the Agricultural Business curriculum, the following courses are required:

Group B Courses (24 Credits)

		Credits
	Electives	24

Group A Courses (6 Credits)

GN 411	Principles of Genetics	3
ZO 301	Animal Physiology	3

Departmental Requirements and Electives (26 Credits)

AI 201	Elements of Dairy Science	4
AI 312	Principles of Livestock Nutrition	3
BO 312	General Bacteriology	4
AI 404	Dairy Farm Problems	3
AI 406	Animal Industry Seminar	1
CH 203	General and Organic Chemistry	4
CH 451	Introduction to Biochemistry	3
AI 502	Reproduction and Lactation	4

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

ZO 301	Animal Physiology	3
CH 451	Introduction to Biochemistry	3
GN 411	Principles of Genetics	3
	Electives*	17

Departmental Requirements and Electives (26 Credits)

AI 201	Elements of Dairy Science	4
AI 305	Selecting Dairy Cattle	
AI 312	Principles of Livestock Nutrition	3
BO 312	General Bacteriology	4
AI 404	Dairy Farm Problems	3
AI 406	Animal Industry Seminar	1
AI 502	Reproduction and Lactation	4
AI 503	Animal Breeding	3
	Elective	2

* Six credits may be elected from Groups B and C.

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum, the following courses are required:

Group A and B Courses (9-12 Credits)

ZO 301	Animal Physiology	3
CH 451	Introduction to Biochemistry	3
GN 411	The Principles of Genetics	3
	Electives	0-3

Group C Courses (9-12 Credits)

	Electives	9-12

Departmental Requirements and Electives (27 Credits)

		Credits
AI 201	Elements of Dairy Science	4
AI 305	Selecting Dairy Cattle	2
AI 312	Principles of Livestock Nutrition	3
BO 312	General Bacteriology	4
AI 404	Dairy Farm Problems	3
AI 406	Animal Industry Seminar	1
AI 502	Reproduction and Lactation	4
AI 503	Animal Breeding	3
	Electives	3

Undergraduate—Dairy Manufacturing

The degree of Bachelor of Science with a major in Dairy Manufacturing may be obtained under any of the three curricula offered by the School of Agriculture.

Agricultural Business. In addition to the requirements of the Agricultural Business curriculum, the following courses are required:

Group B Courses (24 Credits)

		Credits
	Electives	24

Group A and C Courses (6 Credits)

CH 203	General and Organic Chemistry	4
	Elective	2

Departmental Requirements and Electives (26 Credits)

AI 201	Elements of Dairy Science	4
AI 406	Animal Industry Seminar	1
DM 401	Market Milk and Related Products	3
DM 407	Dairy Bacteriology I	4
DM 501	Advanced Dairy Technology	3
DM 504	Dairy Plant Management	4
BO 312	General Bacteriology	4
One of the following:		
DM 402	Cheese	
DM 403	Ice Cream and Related Frozen Dairy Foods	
DM 404	Butter and Dairy By-Products	3

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

BO 312	General Bacteriology	4
DM 407	Dairy Bacteriology I	4
DM 506	Dairy Bacteriology II	3
DM 508	Dairy Chemistry	3
	Electives from Chemistry, Mathematics and Physics	12

Departmental Requirements and Electives (26 Credits)

		Credits
AI 201	Elements of Dairy Science	4
AI 406	Animal Industry Seminar	1
DM 401	Market Milk and Related Products	3
DM 501	Advanced Dairy Technology	3
DM 504	Dairy Plant Management	4
Two of the following:		
DM 402	Cheese	
DM 403	Ice Cream and Related Frozen Dairy Foods	
DM 404	Butter and Dairy By-Products	6
	Electives	5

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum, the following courses are required:

Group A and B Courses (11 Credits)

BO 312	General Bacteriology	4
DM 407	Dairy Bacteriology I	4
	Electives	3

Group C Courses (10 Credits)

AI 201	Elements of Dairy Science	4
	Electives	6

Departmental Requirements and Electives (27 Credits)

AI 406	Animal Industry Seminar	1
DM 401	Market Milk and Related Products	3
DM 501	Advanced Dairy Technology	3
DM 504	Dairy Plant Management	4
DM 506	Dairy Bacteriology II	3
Two of the following:		
DM 402	Cheese	
DM 403	Ice Cream and Related Frozen Dairy Foods	
DM 404	Butter and Dairy By-Products	6
	Electives	7

Graduate

The Department of Animal Industry Offers the Master of Science and Doctor of Philosophy degrees in Animal Industry and in Dairy Manufacturing. The degrees in Animal Industry provide for major programs of work in the fields of animal husbandry, dairy husbandry, animal nutrition, animal diseases, animal physiology and animal breeding.

BOTANY AND BACTERIOLOGY

Gardner Hall

Professor H. T. SCOFIELD, *Head of the Department*
Professors E. A. BALL, H. J. EVANS
Associate Professor L. A. WHITFORD
Assistant Professors E. O. BEAL, A. W. COOPER, G. H. ELKAN, J. W. HARDIN, HEINZ SELTMANN, J. R. TROYER

OBJECTIVES

The course program in the department has the objective of providing undergraduate and graduate instruction in the various specialized phases of basic plant science including microbiology. Undergraduates majoring in the department are usually oriented toward graduate work in this or other fields of science. Courses are supplemented by supervised programs of research for graduate students studying for Master's or Doctor's degrees. Course work in the department is also designed to provide a basis for study in the applied sciences in Agriculture and Forestry.

OPPORTUNITIES

Majors in Botany and Bacteriology may choose to continue graduate work leading to the M. S. and Ph.D. degrees in one of several specialized fields. Majors specializing in Botany are qualified for many technological positions with various government institutions or private industries concerned with agriculture. Majors specializing in Bacteriology find employment opportunities in medical and agricultural industry or in the field of public health.

CURRICULA

Undergraduate—Botany

The degree of Bachelor of Science with a major in Botany can be obtained under the Science curriculum of the School of Agriculture.

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Physical and Biological Sciences

		Credits
CH 203	General and Organic Chemistry	4

Group A Courses

	Electives*	26

Departmental Requirements and Electives

BO 403	Systematic Botany	3
BO 421	Plant Physiology	4
BO 441	Plant Ecology	3
BO 513	Plant Anatomy	3
GN 411	Principles of Genetics	3
PP 315	Plant Diseases	3
BO 312	General Bacteriology	4
	Elective	3

Undergraduate—Bacteriology

The department does not offer an undergraduate degree with a major program in Bacteriology.

Graduate

Botany offers work leading to the Master of Science degree in the special fields of plant physiology, ecology, anatomy, morphology, bacteriology and systematic botany. Graduate work in preparation for the Doctor of Philosophy degree is offered in the fields of plant physiology, plant ecology and morphology.

* **No more than 6 hours of Group A electives may be courses in the Department of Botany, Six credits may be elected from Groups B and C.**

CHEMISTRY

Withers Hall

Professor W. A. REID, J. A. WEYBREW, *Acting Head of the Department*
Professor W. A. REID, *In Charge of Chemistry Teaching*
Professors C. C. ROBINSON, G. H. SATTERFIELD, P. P. SUTTON, J. A. WEYBREW
Associate Professors T. G. BOWERY, A. F. COOTS, R. R. HENTZ, W. E. JORDAN, R. H. LOEPPERT, S. B. TOVE, R. C. WHITE
Assistant Professors T. J. BLALOCK, W. P. INGRAM, JR., G. G. LONG, R. O. SIMMONS, R. L. STEVENS
Instructors J. L. HALL, JR., J. W. MORGAN, G. M. OLIVER, T. M. WARD, DAVID WILLIS

OBJECTIVES

Instruction in Agricultural and Biological Chemistry trains students in these areas of chemistry, strongly supported with fundamental training in the major division of chemistry and their applications.

OPPORTUNITIES

Students trained in chemistry find employment in laboratories maintained in connection with programs for the inspection and control of foods, pharmaceutical products, animal feeds, fertilizers, gasoline and other materials; with experiment stations and other federal and state agencies;

and in technical and business positions in the processing, manufacture, sale, distribution and use of a wide range of agricultural and industrial products. In addition, they receive excellent preparation for graduate study leading to research and teaching positions.

CURRICULA

Undergraduate

The degree of Bachelor of Science may be earned under the Agricultural Science curriculum of the School of Agriculture.

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Languages (16 credits)

		Credits
ML 103	Elementary German	3
ML 104	German Grammar and Prose Reading	3

Physical and Biological Sciences (24 Credits)

MA 101, 102	First Year Math for Engineers	9
CH 201, 205	General Inorganic and Qualitative Chemistry	10
PY 201	General Physics	5

*Group A Courses (22 Credits)**

MA 201, 202	Calculus I, II	8
PY 202	General Physics	5
CH 211, 212	Quantitative Chemistry	8
	Elective	1

Departmental Requirements and Electives (26 Credits)

CH 421, 422	Organic Chemistry	10
CH 531, 532	Physical Chemistry	8
	Electives	8**

Graduate

The Department of Chemistry offers the degree of Master of Science in Chemistry. Several specialized areas for research studies are available for students in the department.

* **Four additional hours in Group A are met in the Physical and Biological Sciences Group.**
** **Six hours must be Chemistry electives.**

NOTE: AGR 103 is optional for majors in Chemistry.

DAIRY HUSBANDRY

See ANIMAL INDUSTRY

DAIRY MANUFACTURING

See ANIMAL INDUSTRY

ENTOMOLOGY

Gardner Hall

Professor CLYDE F. SMITH, *Head of the Department*
Professor Emeritus B. B. FULTON
Professors W. M. KULASH, T. B. MITCHELL
Associate Professors C. H. BRETT, D. A. YOUNG, JR.
Assistant Professors W. V. CAMPBELL, R. B. CHALFANT, M. H. FARRIER, R. T. GAST, F. E. GUTHRIE, W. J. MISTRIC, H. H. NEUNZIG, R. L. RABB, W. A. STEPHEN, G. F. TURNIPSEED

OBJECTIVES

The Entomology faculty offers instruction at both undergraduate and graduate levels and provides students in this field the broad and fundamental training necessary in this profession. Undergraduate instruction is also designed to provide introductory and terminal courses in insect control technology for students majoring in other areas of agriculture and in forestry.

OPPORTUNITIES

Opportunities for employment of well-trained entomologists are plentiful and varied. Research and teaching opportunities exist in many state institutions. Federal agencies offer many positions in control, research and regulatory work. Private industry is using more and more entomologists in the development, production, control testing and sale of agricultural chemicals. Other opportunities in entomology as consultants in domestic or foreign service as well as in private business and sales are available. Or, one can go into business for himself as a pest control operator or an insecticide formulator.

CURRICULA

Undergraduate

The degree of Bachelor of Science with a major in entomology is offered under the Agricultural Science curriculum of the School of Agriculture.

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

		Credits
SOI 200	Soils, or	
MIG 120	Geology	4 or 3
BO 312	General Bacteriology	4
GN 411	Principles of Genetics	3
CH 451	Introductory Biochemistry, or Equivalent	3
ST 311	Introduction to Statistics	3
BO 421	Plant Physiology, or	
ZO 301	Animal Physiology	4 or 3
ZO 205	Invertebrate Zoology	4
	Elective*	3

Departmental Requirements and Electives (26 Credits)

ENT 312	Economic Entomology, or	
ENT 301	General Entomology	3
ENT 511	Systematic Entomology	3
	Entomology electives	6
	Advised electives	14

* May be taken from Groups B and C.

AGRICULTURE

Agricultural Technology. The departments of Field Crops, Entomology and Plant Pathology offer a joint major in Plant Protection. See page 65 for details.

Graduate

The M.S. and Ph.D. degrees are offered in Entomology. The work in Entomology is well supported by strong departments in chemistry, statistics, and the plant and animal sciences.

* **May be elected from Groups B and C.**

EXPERIMENTAL STATISTICS

Patterson Hall

Professor J. A. RIGNEY, *Head of the Department*
Professors R. L. ANDERSON, GERTRUDE M. COX, A. L. FINKNER, R. J. HADER, H. L. LUCAS, D. D. MASON, R. J. MONROE, H. F. ROBINSON
Associate Professors C. C. COCKERHAM, A. H. E. GRANDAGE, F. E. MCVAY
Assistant Professors MELVIN W. CARTER, J. FLEISCHER, D. F. MATZINGER, R. H. MOLL, W. G. SMART, F. J. VERLINDEN
Instructor C. W. GRAY (jointly with Psychology Department)

OBJECTIVES

The Department of Experimental Statistics is a part of the Institute of Statistics. It provides instruction, consultation, experimental and computational service for all other departments of all schools in the college. The Agricultural Experiment Station received assistance in designing experiments, analyzing and interpreting results. Governmental agencies and other institutions use the facilities of the Department. The range and quality of data handled furnish an excellent background for training students in the use of statistical procedures in such fields as the biological, physical and social sciences and in industrial development and engineering.

OPPORTUNITIES

Most fields of research, development, production and distribution are seeking persons trained in statistical methods and theory. Research groups are fast realizing the importance of statistical aids in planning experiments and in analyzing and computing results. Industry is placing increasing reliance on statistical methods to control the quality of goods in the process of manufacture and to determine the acceptability of goods already produced. Statistical procedures are becoming basic tools for making weather forecasts, crop and livestock estimates, business trend predictions, opinion polls and the like.

A graduate in Statistics will find abundant opportunities in any of the areas listed above—both in industry and with federal and state agencies.

CURRICULA

Undergraduate

The degree of Bachelor of Science with a major in Experimental Statistics is offered under the Agricultural Science curriculum of the School of Agriculture.

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Languages (6 Credits)

		Credits
ENG 231	Basic Speaking Skills	3
ENG 321	Scientific Writing	3

Social Sciences and Humanities (6 Credits)

PHI 201	Logic	3
EC 201	Economics	3

Physical and Biological Sciences (23 Credits)

MA 101, 102	1st Year Mathematics for Engineers	9
CH 101, 103	General Inorganic and Qualitative Chemistry	8
PY 201	General Physics	5

Group A Courses (25 Credits)

MA 401	Differential Equations	3
MA 511a	Advanced Calculus	3
PY 202	General Physics	5
MA 405	Introduction to Determinants and Matrices	3
	Electives from "Minor Area" *	11

Departmental Requirements and Electives (25 Credits)

ST 361, 362	Introduction to Statistics	6
ST 521, 522	Basic Statistical Theory	8
MA 201, 202	Calculus I, II	8
	French, German, Spanish, or Russian	3

* **An area of concentration should be chosen prior to the beginning of the Junior year. A program of not less than four related courses, including at least one 500-level course, should be scheduled in this area of concentration to provide familiarity with a scientific field to which Statistics could be applied.**

Graduate

The Department of Experimental Statistics offers work leading to the Master of Science and Doctor of Philosophy degrees. There is a working arrangement with the Department of Biostatistics in the University's School of Public Health at Chapel Hill. Introductory courses of these two departments are coordinated so that it is easy for a beginning statistics student to transfer from one institution of the Consolidated University to another.

The Department has at least one staff member who consults with researchers in each of the following fields and who conducts his own research on statistical problems which are encountered: the various agricultural sciences, quantitative genetics, industry and engineering, physical sciences and social sciences. In addition there is active research in the general fields of experimental design and sample surveys.

FIELD CROPS

Williams Hall

Professor P. H. HARVEY, *Head of the Department*
Professors D. U. GERSTEL, W. C. GREGORY, K. R. KELLER, G. C. KLINGMAN, R. L. LOVVORN, T. J. MANN, P. A. MILLER, G. K. MIDDLETON, R. P. MOORE, J. C. RICE
Associate Professors C. A. BRIM, D. S. CHAMBLEE, G. L. JONES, LUTHER SHAW, D. L. THOMPSON
Assistant Professors I. T. CARLSON, W. A. COPE, J. W. DUDLEY, D. A. EMERY, W. T. FIKE, W. B. GILBERT, H. D. GROSS, G. R. GWYNN, J. A. LEE, W. M. LEWIS, F. W. MCLAUGHLIN, J. R. MAUNEY, D. E. MORELAND, L. L. PHILLIPS, C. L. RHYNE, JR., R. P. UPCHURCH
Instructors W. K. COLLINS, A. J. CROWLEY

OBJECTIVES

The curriculum in Field Crops aims at training the student in the fundamental principles of the plant sciences, along with the application of these principles to the problems of crop production.

The importance of agronomic training in North Carolina agriculture is shown by the fact that North Carolina ranks third among the states in cash income from farm crops. Yet the maximum potential production of farm crops has by no means been reached. With continued improvement in varieties, cultural practices and cropping methods, further advances will be made. In carrying out this broad program there is, and will continue to be, a real need in North Carolina for men well trained in plant breeding, crop production and management and related fields.

OPPORTUNITIES

Graduates in Field Crops are trained to fill positions as county extension agents; farm operators and managers; salesmen in seed and fertilizer companies and similar commercial concerns; seed analysts; and as leaders in various forms of agricultural development work. The Field Crops programs also offer training for those students who might want to continue their education with graduate study in preparation for extension, teaching or research positions with state or federal institutions or private industry.

CURRICULUM

Undergraduate

The degree of Bachelor of Science with a major in Field Crops can be earned under any of the three curricula in the School of Agriculture.

Agricultural Business. In addition to the requirements of the Agricultural Business curriculum, the following courses are required:

Group B Courses (24 Credits)

		Credits
AGC 303	Farm Management I	3
AGC 311	Marketing Agricultural Products, or	
AGC 342	Marketing Field Crops	3
EC 407	Business Law I	3
	Electives	15

Group A and C Courses (6 Credits)

GN 411	The Principles of Genetics	3
	Elective	3

Departmental Requirements and Electives (26 Credits)

FC 211	Field Crops I	3
FC 312	Pastures and Forage Crops	3
FC 414	Weeds and Their Control	3
BO 421	Plant Physiology	4
ENT 312	Economic Entomology	3
PP 315	Plant Diseases	3
SOI 200	Soils	4
SOI 302	Soils and Plant Growth, or	
SOI 341	Soil Fertility	3

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required.

Group A Courses (26 Credits)

		Credits
BO 312	General Bacteriology	4
GN 411	The Principles of Genetics	3
PP 315	Plant Diseases	3
MA 201	Calculus I, or	
MA 211	Analytic Geometry and Calculus B	3 or 4
	Electives*	12 or 13

Departmental Requirements and Electives (26 Credits)

FC 211	Field Crops I	3
FC 312	Pastures and Forage Crops	3
FC 414	Weeds and Their Control	3
BO 421	Plant Physiology	4
ENT 312	Economic Entomology	3
SOI 200	Soils, or	
SOI 302	Soils and Plant Growth	4
SOI 341	Soil Fertility and Fertilizers	3
	Elective	3

* Six credits may be elected from Groups B and C.

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum, the following courses are required:

Group A and B Courses (9-12 Credits)

		Credits
GN 411	The Principles of Genetics	3
PP 315	Plant Diseases	3
	Electives	3-6

Group C Courses (9-12 Credits)

	Electives	9-12

Departmental Requirements and Electives (27 Credits)

FC 211	Field Crops I	3
FC 311	Field Crops II	3
FC 312	Pastures and Forage Crops	3
FC 413	Plant Breeding	3
FC 414	Weeds and Their Control	3
BO 421	Plant Physiology	4
ENT 312	Economic Entomology	3
SOI 302	Soils and Plant Growth, or	
SOI 341	Soil Fertility and Fertilizers	3
	Elective	2

AGRICULTURE

The departments of Field Crops, Entomology and Plant Pathology offer a joint major in Plant Protection. See page 65 for details.

Graduate

The Department of Field Crops offers training leading to the degrees of Master of Science and Doctor of Philosophy in the following fields: plant breeding, crop production, forage crop ecology and weed control.

GENETICS

Gardner Hall

Professor H. F. ROBINSON*, *Head of the Department*
Professors C. H. BOSTIAN, D. S. GROSCH, S. G. STEPHENS
Associate Professors C. CLARK COCKERHAM*, BEN W. SMITH
Assistant Professors D. F. MATZINGER*, L. E. METTLER, R. H. MOLL*
Assistant Geneticist KEN-ICHI KOJIMA*
Cooperating with the following Associate Members of the Faculty:
Animal Industry—D. U. DILLIARD, BARTON FARTHING, J. E. LEGATES, H. A. STEWART
Botany—E. O. BEAL, JAMES W. HARDIN
Field Crops—P. H. HARVEY, C. A. BRIM, I. T. CARLSON, W. A. COPE, J. W. DUDLEY, D. A. EMORY, D. U. GERSTEL, W. C. GREGORY, G. L. JONES, K. R. KELLER, J. A. LEE, W. M. LEWIS, T. J. MANN, G. K. MIDDLETON, P. A. MILLER, L. L. PHILLIPS, C. L. RHYNE, D. L. THOMPSON
Horticulture—F. D. COCHRAN, F. L. HAYNES, W. R. HENDERSON, D. T. POPE, C. F. WILLIAMS
Plant Pathology—J. L. APPLE, RICHARD GWYN, T. T. HEBERT, E. L. MOORE, R. R. NELSON, N. N. WINSTEAD
Poultry—E. W. GLAZENER, W. L. BLOW, G. A. MARTIN
Forestry—B. J. ZOBEL

* Joint appointments with the Department of Experimental Statistics.

OBJECTIVES

The genetics faculty offers instruction at advanced undergraduate and graduate levels. The undergraduate courses are designed to support the other departments of the institution, giving students a background in the science of genetics. The graduate program is designed to train scientists for research and teaching careers in basic genetics and in its applications in plant and animal breeding.

CURRICULA

Undergraduate

The faculty does not have a program leading to the Bachelor of Science degree.

Graduate

Graduate study is carried out under the direction of any of the members of the Genetics Faculty and enables the student to qualify for the Master of Science or the Doctor of Philosophy degree. A candidate for the Master's degree must acquire a thorough understanding of genetics and its relation to other biological disciplines and must present a thesis based upon his own research. In addition to a comprehensive knowledge of his field, a candidate for the doctorate must demonstrate his capacity for independent investigation and scholarship in genetics.

The basic aspects of quantitative genetics, cytogenetics, physiological genetics and mutation genetics as related to past and future evolution of organisms is the central theme of the training program and research. The

varied but coordinated interests of the genetics faculty with their research programs offers a variety of opportunities for graduate student training that is found at few other institutions. Experimental studies utilize organisms ranging from microbes, mice and drosophila to trees and economic farm animals.

HORTICULTURE

Kilgore Hall

Professor FRED D. COCHRAN, *Head of the Department*
Professors J. L. ETCHELLS, M. E. GARDNER, J. B. GARTNER, J. M. JENKINS, JR., I. D. JONES, G. O. RANDALL, C. F. WILLIAMS
Associate Professors F. L. HAYNES, JR., C. L. MCCOMBS, M. W. HOOVER, D. T. POPE, D. R. WALKER
Assistant Professors W. E. BALLINGER, T. F. CANNON, C. H. MILLER, R. J. SCHRAMM, JR.
Instructors F. E. CORRELL, V. H. UNDERWOOD

OBJECTIVES

The programs in horticulture offer training in basic principles of the plant sciences, along with the application of these principles to the production, breeding, handling and marketing of fruit, vegetable and ornamental crops, and also to the processing and utilization of fruits and vegetables.

The variations in climatic conditions in North Carolina are conducive to the production of a wide variety of horticultural crops which are distributed throughout the state as commercial enterprises and as home gardens. While these crops now represent an important segment of agriculture in the state, further expansion will be realized with development of adapted varieties, mechanization and intensification of cultural practices, and improvement of handling and marketing methods.

OPPORTUNITIES

Graduates in Horticulture will find numerous opportunities in a wide variety of positions in production, processing, and sales. Among these are County Extension Agents; farm operators; orchard, nursery, greenhouse and flower shop managers; research and promotional specialists with commercial seed, floral, fertilizer, chemical, and food companies and processing plants; inspectors and quality control technologists; USDA specialists; and as leaders in other phases of agricultural and industrial developments. In addition, the student may prepare himself for one of the many opportunities for graduate study.

CURRICULA

Undergraduate

The degree of Bachelor of Science with a major in Horticulture can be earned under any of the three curricula offered by the School of Agriculture. Under these curricula, specialized training is offered for horticulture majors in **Fruit and Vegetable Crops** and in **Ornamental Crops**; in addition, specialization in **Fruit and Vegetable Processing** is offered in the Agricultural Technology curriculum.

Agricultural Business. In addition to the basic requirements of the Agricultural Business Curriculum, the following courses are required for specialization in **Fruit and Vegetable Crops** or **Ornamental Crops:**

Group B Courses (24 Credits)

		Credits
	Electives	24

Group A and C Courses (6 Credits)

ENT 312	Economic Entomology	3
PP 315	Plant Diseases	3

Departmental Requirements and Electives (26 Credits)

CH 103	General and Qualitative Chemistry	4
SOI 200	Soils	4
	Electives	6

Four courses in Fruit and Vegetable Crops

HRT 321	Grading, Packing and Inspection of Fruits and Vegetables	3
HRT 421	Fruit Production	3
HRT 432	Vegetable Production	3
HRT 452	Principles of Fruit and Vegetable Processing	3
	OR	

Four courses in Ornamental Crops

HRT 311, 412	Nursery Practice; Outdoor Production of Floral Crops	
or		
HRT 441, 442	Commercial Floriculture	6
HRT 301	Plant Propagation	3
HRT 342	Landscape Gardening	
or		
HRT 331	Floral Design and Shop Management	3
		12

Agricultural Science. In addition to the basic requirements of the Agricultural Science Curriculum, the following courses are required for specialization in **Fruit and Vegetable Crops** or **Ornamental Crops:**

Group A Courses (26 Credits)

		Credits
BO 312	General Bacteriology	4
BO 421	Plant Physiology	4
CH 203	Organic Chemistry	4
GN 411	Principles of Genetics	3
SOI 200	Soils	4
	Electives	7

Departmental Requirements and Electives (26 Credits)

ENT 312	Economic Entomology	3
PP 315	Plant Diseases	3
	Electives	8

Four courses in Fruit and Vegetable Crops

HRT 421	Fruit Production	3
HRT 432	Vegetable Production	3
HRT 452	Principles of Fruit and Vegetable Processing	3
HRT 562	Handling and Storage of Fruits and Vegetables	3

OR

Four courses in Ornamental Crops

HRT 201, 202	Plant Materials	6
HRT 441 or	Commercial Floriculture	
HRT 311	Nursery Practice	3
HRT 512	Handling and Storage of Ornamental Plants	3

12

Agricultural Technology. For specialization in **Fruit and Vegetable Crops** or **Ornamental Crops** the following courses are required in addition to the basic requirements of the Agricultural Technology curriculum.

Group A and B Courses (10 Credits)

		Credits
BO 421	Plant Physiology	4
GN 411	Genetics	3
PP 315	Plant Diseases	3

Group C Courses (11 Credits)

		Credits
SOI 341	Soil Fertility and Fertilizers	3
HRT 481	Breeding of Horticultural Plants	3
	Electives	5

Departmental Requirements and Electives (27 Credits)

ENT 312	Economic Entomology	3
	Electives	6

Six courses in Fruit and Vegetable Crops

AGC 364	Marketing of Fruits and Vegetables	3
HRT 321	Grading, Packing and Inspection of Fruits and Vegetables	3
HRT 421	Fruit Production	3
HRT 432	Vegetable Production	3
HRT 452	Principles of Fruit and Vegetable Processing	3
HRT 462	Grading and Inspection of Processed Fruits and Vegetables	2

OR

Six courses in Ornamental Crops

HRT 201, 202	Plant Materials	6
HRT 311 or	Nursery Practice	

HRT 442	Commercial Floriculture	3
HRT 342	Landscape Gardening	
or		
HRT 331	Floral Design and Shop Management	3
HRT 412	Outdoor Production of Floral Crops	
or		
HRT 441	Commercial Floriculture	3
HRT 512	Handling and Storage of Ornamental Plants	3
		18

For specialization in **Fruit and Vegetable Processing** the following courses are required in addition to the basic requirements of the Agricultural Technology curriculum.

Group A and B Courses (12 Credits)

		Credits
PY 212	General Physics	4
CH 215	Quantitative Analysis	4
BO 421	Plant Physiology	4

Group C Courses (9 Credits)

		Credits
AGE 331	Dairy Engineering	3
HRT 222	Introduction to Horticulture	3
	Elective	3

Departmental Requirements and Electives (27 Credits)

BO 312	General Bacteriology	4
CH 425, 426	Organic Chemistry	6
HRT 321	Grading, Packing and Inspection of Fruits and Vegetables	3
HRT 452	Principles of Fruit and Vegetable Processing	3
HRT 462	Grading and Inspection of Processed Fruits and Vegetables	2
HRT 562	Handling and Storage of Fruits and Vegetables	3
	Electives	6

Graduate

The Department of Horticulture offers the Master of Science degree and the professional degree, Master of Horticulture.

The professional degree is designed for those interested in application of current knowledge, while the M.S. degree places emphasis on research and provides a basis for later study on the Ph.D. degree.

PLANT PATHOLOGY

Gardner Hall

Professor D. E. ELLIS, *Head of the Department*
Professors C. N. CLAYTON, F. A. HAASIS, T. T. HEBERT, A. KELMAN, L. W. NIELSEN, C. J. NUSBAUM
Professor Emeritus S. G. LEHMAN
Associate Professors G. B. LUCAS, E. L. MOORE, J. N. SASSER, N. N. WINSTEAD
Assistant Professors J. L. APPLE, W. E. COOPER, HEDWIG HIRSCHMANN, D. M. KLINE, R. R. NELSON, N. T. POWELL

OBJECTIVES

Undergraduate instruction in Plant Pathology is designed to provide introductory and advanced courses in the nature and control of plant diseases to students majoring in field crops, horticulture, plant protection, agricultural education, and forestry, and to provide students with the fundamental training necessary for graduate study in plant pathology.

OPPORTUNITIES

Many opportunities for employment in research, extension and teaching are available to men with advanced degrees in the field of plant pathology. Openings are available for qualified men in research in the USDA, state experiment stations and in industry. The rapid development of agricultural chemicals and other methods for disease control offer numerous opportunities. (See Plant Protection Curriculum, page 66).

CURRICULA

Undergraduate

The Plant Pathology department cooperates in the training of plant protection majors (See below), but does not offer a major in plant pathology at the undergraduate level.

Graduate

The M.S. and Ph.D. degrees are offered in this department.

PLANT PROTECTION MAJOR

The major in Plant Protection is a joint major in the departments of Entomology, Field Crops, and Plant Pathology.

OBJECTIVES

Students in Plant Protection will be trained in the application of chemical and biological principles for the control of plant diseases, insects and weeds. Crop losses from insects, weeds and diseases for the past several years have been estimated in excess of 10 billion dollars annually in the United States. A knowledge of the organisms to be controlled, the products to be used and the crops to be grown is basic to any control or regulatory program.

OPPORTUNITIES

Opportunities in Plant Protection basically involve improving farm efficiency to meet our ever-growing need for food and fiber. About 340 chemical companies are concerned with manufacturing and formulating pro-

ducts for pest control. Technically trained men are needed for sales development and promotion of agricultural chemicals. Graduates are also trained to fill positions as county extension agents or as state and federal regulatory agents. This major is primarily intended for a B. S. degree. However, qualified students can go on to graduate school from this curriculum.

CURRICULUM

Undergraduate

The degree of Bachelor of Science with a major in Plant Protection is offered under the Agricultural Technology curriculum of the School of Agriculture.

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum, the following courses are required:

Group A and B Courses (9-12 Credits)

		Credits
CH 425	Organic Chemistry	3
CH 426	Organic Chemistry	
or		
CH 451	Introductory Biochemistry	3
GN 411	The Principles of Genetics	3
	Electives	0-3

Group C Courses (9-12 Credits)

FC 211	Field Crops I	3
HRT 222	Introduction to Horticulture	3
	Electives	3-6

Departmental Requirements and Electives (27 Credits)

BO 421	Plant Physiology	4
BO 312	General Bacteriology	4
ENT 312	Economic Entomology	3
	Entomology Elective	3
PP 315	Plant Diseases	3
	Plant Pathology Elective	3
FC 414	Weeds and Their Control	3
	Electives	4

POULTRY SCIENCE

Scott Hall

Professor E. W. GLAZENER, *Head of the Department*
Professor C. W. BARBER
Professor Emeritus R. S. DEARSTYNE
Associate Professors T. T. BROWN, F. R. CRAIG, H. W. GARREN, C. H. HILL, J. W. KELLY
Assistant Professors W. L. BLOW, H. L. BUMGARDNER, F. W. COOK, D. FROMM, G. A. MARTIN

OBJECTIVES

The Department of Poultry Science has as its objectives training the student in the principles of poultry husbandry and related scientific fields, and the application of these principles to the poultry industry. These principles include the evaluation, preparation and processing of poultry and poultry products: breeding, nutrition and diseases; and management of commercial poultry enterprises.

Through teaching, research and extension, the department serves students, poultrymen and allied industries. Poultry is among the most rapidly expanding industries in North Carolina, and production has increased tremendously during the past few years.

OPPORTUNITIES

The demand for graduates in Poultry Science has increased greatly with the upswing in poultry production in the state. Graduates hold positions as managers and field representatives for feed manufacturers, processors, hatcheries, equipment companies, biological supply houses and other enterprises in poultry and allied industries. They also work in communications and public relations and as teaching, extension and research specialists. Several graduates have established their own poultry business.

CURRICULA

Undergraduate

The degree of Bachelor of Science with a major in Poultry Science can be obtained in any of the three curricula offered by the School of Agriculture.

Agricultural Business. In addition to the requirements of the Agricultural Business curriculum, the following courses are required:

Group A and C Courses (7 Credits)

		Credits
GN 411	The Principles of Genetics	3
CH 203	General and Organic Chemistry	4

Group B Courses (24 Credits)

	Electives	24

Departmental Requirements and Electives (27 Credits)

PO 201	Poultry Production	4
PO 301	Poultry Quality Evaluations	2
PO 401	Poultry Diseases	4
PO 402	Commercial Poultry Enterprises	4
PO 403	Poultry Seminar	1 + 1
PO 404	Poultry Products	3
PO 521	Poultry Nutrition	3
ZO 301	Animal Physiology	4

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

		Credits
BO 312	General Bacteriology	4
CH 451	Introductory Biochemistry	3
GN 411	The Principles of Genetics	3
ZO 301	Animal Physiology	4
	Electives*	12

Departmental Requirements and Electives (26 Credits)

PO 201	Poultry Production	4
PO 401	Poultry Diseases	4
PO 403	Poultry Seminar	1 + 1
PO 404	Poultry Products	3
PO 520	Poultry Breeding	3

PO 521	Poultry Nutrition	3
PO 522	Endocrinology of the Fowl	3
ZO 561	Animal Embryology	4

* Six credits may be elected from Groups B and C.

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum, the following courses are required:

Group A and B Courses (11 Credits)

		Credits
ZO 301	Animal Physiology	4
GN 411	The Principles of Genetics	3
BO 312	General Bacteriology	4

Group C Courses (10 Credits)

	Electives	10

Departmental Requirements and Electives (27 Credits)

PO 201	Poultry Production	4
PO 301	Poultry Quality Evaluations	2
PO 401	Poultry Diseases	4
PO 402	Commercial Poultry Enterprises	4
PO 403	Poultry Seminar	1 + 1
PO 404	Poultry Products	3
PO 521	Poultry Nutrition	3
PO 520	Poultry Breeding	3
	Electives	2

Graduate

The M.S. degree is offered in Poultry Science with major studies in genetics, nutrition, veterinary pathology and physiology. Fundamental work in chemistry, biochemistry, physiology, bacteriology, statistics and fields that relate directly to the major interest are required as a part of the program for the M.S. degree.

PRE-VETERINARY

A pre-veterinary curriculum is offered as part of a working agreement with two Southern veterinary colleges. After the completion of the prescribed work (usually 2 years) eight North Carolina students are selected each year to attend the University of Georgia and four to attend the Veterinary College at Oklahoma State University at in-state rather than out-of-state tuition rates.

The first year's work (up to 42 credits) at either Georgia or Oklahoma may be transferred back to North Carolina State College and counted toward graduation requirements for a B.S. degree from N. C. State in Zoology, Animal Industry or Poultry Science.

CURRICULUM

The pre-veterinary program is offered under the Agricultural Science curriculum of the School of Agriculture.

Agricultural Science. The courses listed below are minimum requirements for all students applying for entrance to veterinary school under the Southern Regional Education Board contract. Only those students who complete the required courses successfully (grade of C or better on each) will be considered eligible to apply. An over-all 2.50 scholastic average or better is mandatory for application to Oklahoma State University.

Languages (9 Credits)		*Credits*
ENG 111, 112	English Composition	6
	English Elective	3

Social Science and Humanities (6 Credits)		
HI 261	The U. S. in Western Civilization	3
PS 201	American Government System	3

Physical and Biological Sciences (36 Credits)		
MA 111, 112	Algebra and Trigonometry; Analytic Geometry and Calculus A	8
CH 101, 103	General Inorganic Chemistry; General and Qualitative Chemistry	8
CH 203	General and Organic Chemistry	4
CH 451	Introductory Biochemistry	3
PY 211, 212	General Physics	8
BO 103	General Botany	4
ZO 103	General Zoology	4
ZO 223	Comparative Anatomy	4

Group C Courses (12 Credits)		
AI 201	Elements of Dairy Science	4
AI 202	Fundamentals of Animal Husbandry	4
PO 201	Poultry Production	4

RURAL SOCIOLOGY

1911 Building

Professor C. HORACE HAMILTON, *Head of the Department*
Professor SELZ C. MAYO
Assistant Professors GLENN C. MCCANN, JAMES N. YOUNG

OBJECTIVES

The principal aim of this department is to teach students the principles and techniques for understanding human group behavior. More specifically the Department seeks (1) to train students to become leaders in organizing rural groups and communities and in administering their programs; (2) to qualify exceptional students on the undergraduate and graduate levels for rural 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.

OPPORTUNITIES

Graduates of this Department may obtain employment as community organization specialists, county agents, social welfare workers, social statisticians, administrators and managers of both public and private social agencies, college teachers, research workers and many other capacities.

Among the institutions offering employment to graduates are land-grant colleges, agricultural experiment stations and extension services; the United States Departments of Agriculture, State, and Health Education and Welfare; state departments of welfare, health and education; farm journals and newspapers; voluntary social agencies, such as Red Cross, Community Chest and Boy Scouts; and rural fraternal organizations and co-

operatives. The range of vocational pursuits open to rural sociology graduates is constantly widening.

CURRICULUM

Undergraduate

The degree of Bachelor of Science with a major in Rural Sociology is offered under the Agricultural Science curriculum of the School of Agriculture.

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

		Credits
ST 311	Introduction to Statistics	3
GN 411	Principles of Genetics	3
MIG 120	Physical Geology	3
ST 302	Statistical Laboratory	2
	Electives*	15

Departmental Requirements and Electives (26 Credits)

SOC 202	Man and Society	3
RS 301	Sociology of Rural Life	3
SOC 301	Human Behavior	3
ANT 252	Cultural Anthropology	3
RS 321	Introduction to Social Research	2
RS 442	Rural Social Structure	3
	Electives	9

* Six Credits may be elected from Groups B and C. Additional electives may be chosen from Group D.

Graduate

The Master of Science and the Doctor of Philosophy degrees are offered by this Department. Graduate students studying for the Ph.D. degree are required to take approximately 15 semester hours in the Department of Sociology at the University of North Carolina, Chapel Hill, N. C. Students seeking the M.S. degree may take courses at Chapel Hill, but normally will be able to complete their entire programs at State College.

Advanced work in Rural Sociology provides training in a number of social sciences and prepares the graduate student for a wide variety of positions.

SOILS

Williams Hall

Professor J. W. FITTS, *Head of the Department*
Associate Professor HOMER C. FOLKS, *In Charge, Soils Teaching*
Professors W. V. BARTHOLOMEW, N. T. COLEMAN, J. F. LUTZ, W. G. WOLTZ, W. W. WOODHOUSE, JR.
Associate Professors E. J. KAMPRATH, C. B. MCCANTS, R. J. MCCRACKEN, A. MEHLICH, J. R. PILAND, W. H. RANKIN, R. J. VOLK
Assistant Professors MATTHEW GILBERT, E. F. GOLDSTON, W. A. JACKSON, P. H. REID, S. B. WEED
Instructors D. L. CRAIG, A. H. HUNTER, E. O. SKOGLEY

OBJECTIVES

The primary objective of the Soils Department is to train students in the fundamental principles of soils, its utilization and management. Soils constitute one of the largest capital investments in farming and proper soil management is essential for efficient production. Therefore, the demand by educational, research and service agencies and by industry for men trained in soils should continue to be great.

OPPORTUNITIES

Soils graduates are trained to fill positions of leadership in many areas of agricultural work, such as County Extension agents; farm operators and managers; Soil Conservation Service representatives; technicians or salesmen in fertilizer companies. Provision is also made for those students who wish to obtain a more thorough training in mathematics, chemistry, physics and biological sciences in anticipation of graduate study. Students with advanced degrees have unlimited opportunities in teaching, research and extension with state and federal institutions as well as increasing opportunities with commercial concerns.

CURRICULA

Undergraduate

The degree of Bachelor of Science with a major in Soils is offered under all three of the curricula in the School of Agriculture.

Agricultural Business. In addition to the requirements of the Agricultural Business curriculum, the following courses are required:

Group B Courses (24 Credits)

		Credits
	Electives	24

Group A and C Courses (6 Credits)

	Electives	6

Departmental Requirements and Electives (26 Credits)

MIG 120	Physical Geology	3
SOI 200	Soils	4
SOI 341	Soil Fertility and Fertilizers	3
SOI 302	Soils and Plant Growth	3
SOI 480	Senior Seminar	1
SOI 461	Soil Conservation and Management	3
SOI 452	Soil Classification	3
	Electives	6

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Group A Courses (26 Credits)

		Credits
MA 201	Calculus I	4
MA 202	Calculus II	4
MIG 120	Physical Geology	3

BO 312	General Bacteriology	4
BO 421	Plant Physiology	4
PY 212	General Physics	4
	Elective*	3

Departmental Requirements and Electives (26 Credits)

	Chemistry	12
SOI 200	Soils	4
SOI 480	Senior Seminar	1
SOI 341	Soil Fertility and Fertilizers	3)
SOI 302, 302L	Soils and Plant Growth	4)-9
SOI 461	Soils Conservation and Management	3)
SOI 452	Soil Classification	3)

* May be elected from Groups B and C.

Agricultural Technology. In addition to the requirements of the Agricultural Technology curriculum, the following courses are required:

Group A and B Courses (9-12 Credits)

	Credits
Electives	9-12

Group C Courses (9-12 Credits)

Electives	9-12

Departmental Requirements and Electives (27 Credits)

MIG 120	Physical Geology	3
BO 312	General Bacteriology	4
BO 421	Plant Physiology	4
SOI 341	Soil Fertility and Fertilizers	3
SOI 302	Soils and Plant Growth	3
SOI 480	Senior Seminar	1
SOI 461	Soil Conservation and Management	3
SOI 452	Soil Classification	3
	Elective from Group A or B	3

Graduate

The Department of Soils offers training leading to the degrees of Master of Science and Doctor of Philosophy in the following fields: Soil Chemistry, Soil Fertility, Soil Physics, Soil Genesis and Soil Microbiology.

STATISTICS

See EXPERIMENTAL STATISTICS

ZOOLOGY

Gardner Hall

Professor F. S. BARKALOW, JR., *Head of the Department*
Professors B. B. BRANDT, D. S. GROSCH, R. HARKEMA, T. L. QUAY
Assistant Professors W. W. HASSLER, E. M. LOWRY, J. A. SANTOLUCITO
Instructor G. C. MILLER

OBJECTIVES

The Department of Zoology at N. C. State is organized to serve three purposes: (1) It serves the schools of Agriculture, Forestry and Education by teaching courses of a fundamental nature essential to a complete understanding and mastery of applied science; (2) it provides training in zoology which prepares students for positions in industrial and governmental laboratories; (3) it provides undergraduate curricula leading to graduate and professional training in dentistry, medicine, veterinary medicine and advanced zoological sciences; (4) it furnishes potential leaders in the field of wildlife conservation and game management through a curriculum in Wildlife Biology.

OPPORTUNITIES

The zoology program is sufficiently flexible to provide the basic training for students who wish to continue their education at the graduate level, or its equivalent, in numerous special phases.

Five categories of positions are available to wildlife graduates: administrative, law enforcement, refuge, education and research. Agencies employing the majority of trained men are: state game and fish departments, U. S. Fish and Wildlife Service, U. S. Forest Service, U. S. Soil Conservation Service, U. S. National Park Service and other federal land-use departments.

Employment opportunities continue to be good, especially at the graduate level. No excess of wildlife graduates is anticipated in the immediate future.

Unusual advantages are offered by the wide range of natural environments in North Carolina's Coastal Plain, Piedmont and Mountain Regions. Close cooperation with the North Carolina Wildlife Resources Commission provides opportunities for observing developments in wildlife management on its 27 wildlife management and refuge areas.

CURRICULA

Undergraduate—Wildlife Biology

The Department of Zoology offers the degree of Bachelor of Science with a major in Wildlife Biology under the School of Agriculture's Agricultural Science curriculum.

Agricultural Science. In addition to the requirements of the Agricultural Science Curriculum, the following courses are required:

Languages (3 Credits)

		Credits
ENG 231	Basic Speaking Skills	3

Group A Courses (26 Credits)

ZO 205	Invertebrate Zoology	4
ZO 206	Vertebrate Zoology	4

ZO 321	Wildlife and Natural Resource Conservation	3
	One course in Botany	3 or 4
	One course in Entomology	3
	Electives (from Botany, Chemistry, Soils, Geology, Entomology, Genetics, Mathematics and/or Statistics)	5 or 6
	Electives*	3

Departmental Requirements and Electives (26 Credits)

ZO 301	Animal Physiology	4
ZO 223	Comparative Anatomy	4
ZO 522	Animal Ecology	3
ZO 520	Fishery Science	3
ZO 551	Wildlife Science	3
ZO 521	Fishery Science, or	
ZO 552	Wildlife Science	3
	Advised Electives	6

* May be elected from Groups B and C.

Undergraduate—Zoology

The degree of Bachelor of Science with a major in Zoology is offered under the School of Agriculture's Agricultural Science curriculum.

Agricultural Science. In addition to the requirements of the Agricultural Science curriculum, the following courses are required:

Languages (3 Credits)

		Credits
ENG 231	Basic Speaking Skills	3

Group A Courses (26 Credits)

ZO 301	Animal Physiology	4
ZO 223	Comparative Anatomy	4
	One course in Entomology	3
	One course in Genetics	3
	One course in Botany	3 or 4
	Electives (from Botany, Entomology, Genetics, Mathematics, Physics and/or Statistics)	3
	Electives*	6

Departmental Requirements and Electives (26 Credits)

Four courses in Zoology	12-16
Advised electives	10-14

* May be elected from Groups B and C.

Graduate

The Master of Science and the Doctor of Philosophy degrees are offered in animal ecology and wildlife biology. Graduate programs leading to advanced degrees in the areas of animal parasitology and physiology can be arranged in cooperation with the Department of Zoology of the University of North Carolina at Chapel Hill.

THE AGRICULTURAL EXPERIMENT STATION

D. W. Colvard, Dean of Agriculture
R. L. Lovvorn, Director of Research

ESTABLISHMENT

The Agricultural Experiment Station was established in accordance with an Act of the General Assembly of 1877 and amended in 1955. The North Carolina General Assembly has allocated to the Station, annually, certain funds from the General Fund.

OBJECTIVES

The purpose of the Agricultural Experiment Station is to study the basic laws of nature underlying agricultural enterprises and to develop methods for economic production of the highest grades of livestock, poultry and plants on the many soil types and under the varied conditions existing in North Carolina; to study methods for the control of parasitic insects and organisms that cause serious economic losses of animals, poultry and plants; to find and develop varieties of animals, poultry and plants new and resistant to diseases and the changeable conditions prevailing in the state; and to perfect better marketing for all agricultural products.

The staff of the Experiment Station conducts experiments in the greenhouses and laboratories of the College, and throughout the state on areas owned by farmers, on nineteen strategically located experimental farms, and on farms rented for short periods.

The agricultural research aims, through the discovery of new facts, to improve the well-being of farmers throughout the state; to strengthen the regulatory work of the State Department of Agriculture; to develop new and necessary facts for the teaching of sound agricultural principles by vocational agricultural instructors, agricultural extension agents and agricultural instructors in the college.

The Agricultural Experiment Station staff brings to the College many experts, whose teaching in many specialized fields of agriculture assures the maintenance of curricula of high standards. It contributes much 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 many bulletins and scientific papers on results of research conducted by the staff. These are free and are sent upon request to anyone in the state.

SERVICES

The staff diagnoses and interprets many problems for the farmers of North Carolina. It holds council with farmers and others interested in the agricultural industry, presents radio programs devoted to the discussion of farming procedures, and writes many letters on more specific problems of agriculture at the request of farmers, members of garden clubs, and manufacturers of fertilizer, fungicides and insecticides. It also takes part in many of the administrative functions of the College.

COOPERATIVE AGRICULTURAL EXTENSION WORK — — —

D. W. Colvard, Dean of Agriculture
I. O. Schaub, Director Emeritus of Extension
David S. Weaver, Director of Extension

SUPPORT —

The Agricultural Extension Service of State College is conducted cooperatively with the United States Department of Agriculture and with the one hundred counties in North Carolina. Its work is supported by Federal funds derived from the Smith-Lever Act of 1914, the Capper-Ketcham Act of 1928, the Bankhead-Jones Act of 1935, the Bankhead-Flannagan Act of 1945, and by state and county appropriations. Federal and state appropriations are used to maintain an administrative and specialist staff and to supplement salaries and travel expenses of County Extension Agents, who are located at each county seat in the state.

OBJECTIVES — — — — — — — — — — — — — — — — — — —

The purpose of the Extension Service is to take to the rural people of North Carolina the latest and best information obtainable for building a more prosperous and satisfying life on the farm. In carrying out this purpose, the College maintains a staff of trained specialists, as system of county Agents and assistants, and Home Economics Agents who work with the farmer and his family and who administer a state-wide educational program. Work is also done with firms which furnish the tools and supplies for farm production and which market and process agricultural commodities. In these programs, the Extension Service employs a variety of methods and devices. These include method and result demonstrations for group meetings, a training program for farm leaders within the community, and close contact with organized clubs of men, women and young people. The service also publishes a great number of pamphlets, bulletins and circulars which it distributes free. In addition, it holds a number of short courses, both on the College campus and elsewhere throughout the state, to offer rural leaders advice and training in creating better homes and farms and in using more efficient farming practices.

SCHOOL OF DESIGN

HENRY L. KAMPHOEFNER, DEAN

INTRODUCTORY

In 1948 the School of Design was organized through the combination of the existing Departments of Architecture and Landscape Architecture. The 1957 General Assembly appropriated funds for the establishment of a third Department of Product Design. The three departments are devoted and dedicated to the development of a native design and its accompanying art forms for the southern region.

The school in its teaching recognizes the dangers inherent in a materialist-mechanistic civilization where there may be an over-reliance on the machine and the mechanical devices available for use to man in his constructions for shelter. We give attention, therefore, to that larger responsibility of architecture, the art of humanizing the environment.

And, while the natural and organic aspects of design are stressed, the international and universal aspects of design are also respected and related to the humane patterns of life. We seek to integrate the architect as a social human being and the architect as scientist-engineer, and we encourage and nurture the architect-engineer as the coordinator of the structural dynamics in the over-all pattern of life.

While our first aim is to serve North Carolina and the regions of the South, we believe that our students will be equipped, through the teaching of the school, to work in any region.

Because character, a profound devotion, and an absolute professional commitment are prime ingredients of any creative activity where the social responsibilities are as vital as in architecture and design, we foster and cultivate the integrity of the individual.

Individual creative expression is emphasized as the epitome of good design, but teamwork is also encouraged and developed as a necessity of humane progress in the machine civilization of the day. We believe that the "prima donna" who isolates himself behind the intellectual barrier of his own self-sufficiency fails to recognize and understand the importance and necessity of the formal technique of compromise as a dominant factor of design as related to the social pattern of life—just as nature in all her workings adjusts to all pressures and all tensions.

The faculty of the School of Design have been selected for their individual and diverse personal philosophies and their individual yet divergent professional qualifications. We have brought together creative personalities willing in their teaching to subordinate their own professional interests to the pedagogically more important interests of their students. Here a community of scholars working each in his own way searches for the truth as he sees it, giving the young student the benefit of his professional knowledge, his technical training, and his experience as a citizen. We encourage the student to sift and sort this diversity of opinion, even though in this process he is usually stimulated and occasionally confounded. In the end we are confident that he arrives through this process at an ability to shape his own conclusions.

To combat the dangers of over-specialization we seek to develop the personality and character as a whole. The goal in the growth of the student is not only the mastery of the architectural techniques of the profession; but through the stimulation and development of the intellectual and emotional capacities together, a readiness is developed to meet the challenge of any environment.

The School of Design is intended to act as an educational center which unifies different design professions in the fundamental knowledge and methods which they share; its further intention is the education of men who will be competent within the specific demands and limitations of a particular professional field of design. The existence of contemporary design is considered to be a requirement of contemporary man, and the greatest purpose of contemporary design is considered to be the solution of those requirements through full use of the ingenuity and knowledge of contemporary man. Through this point of view the technical and factual aspects of design present no conflict with its philosophical and aesthetic standards, for one is but the particularization of the other. The course is based upon a belief in the basic ambivalence of the process of designing.

The three professional fields have been grouped under one broad and unified study of the methods and values which are common to all designers, and they are separated only in the study of their application in the work of a single profession. Many classes throughout the curricula will include students in these professional fields; and for all students the course of study is the same during the first year in order that, having become more familiar with the whole scope of activity in design, they may then select the design profession in which they are most interested. When this selection has been made, the unity of the school and frequent collaboration prevent the unnatural isolation of any professional group.

Training in drawing, painting, sculpture and other visual arts is conducted by specialists within the staff of the School of Design; the essential knowledge of techniques and materials is taught by this faculty and other departments of the college; and the past and present of the professions are taught by this faculty. These ingredients of design training are assimilated through their application in the design courses. Thus the student is required to combine these studies increasingly as he advances through the course so that he may achieve that comprehensive combination which is a necessity in the designer. Much of the student's work will be done in laboratory courses since design is a matter of the application of knowledge rather than its mere accumulation. From his first day in class to his last the student is asked to design and he is counseled so that he may become a responsible professional in the broadest sense.

CURRICULA

The School of Design offers professional instruction to the undergraduate in Architecture, Landscape Architecture and Product Design. A graduate program in all three departments is projected for the future.

DEGREES

The five-year curricula offer courses of study leading to the Bachelor of Architecture, the Bachelor of Landscape Architecture, and the Bachelor of Product Design.

FACILITIES

In January, 1956, the School of Design moved to Brooks Hall on the College Campus. Brooks Hall is the former Hill Library, built in 1928 and vacated in 1954 after a new million and a quarter dollar library for

the College was completed with State funds. The new Brooks Hall is a remodeling of 28,000 square feet of floor space and a new addition of 20,000 square feet. All of the facilities of the School are now in modern, especially designed quarters under one roof.

OPPORTUNITIES

State law now requires the graduate architect to work not less than three years in the offices of registered architects and to pass the four day written examination given by the North Carolina Board of Architecture before he is ready to commence his own practice. The great national boom in building construction since World War II has brought a tremendous volume of work into the offices of the South, offering many attractive positions for the architectural graduate. The architectural graduate is also qualified for positions in certain branches of engineering, building research and teaching.

Usually the landscape architect practices in one of two ways. He may be a private practitioner with an office serving clients who come to him for help and advice in the same manner as a lawyer, engineer or architect; or he may be an employee of a private or public organization. Organizations commonly employing landscape architects include other practicing landscape architects; city planners; engineers; architects; national, state, and municipal recreation agencies; parkway and highway departments; housing agencies; planning commissions; conservation departments; and universities. Private concerns such as plant nurseries, private estates, botanical and zoological gardens, or construction companies may also employ landscape architects.

Testimony to the soundness of the course of study and program of North Carolina State College is reflected by two of the Department's recent graduates who have been awarded the Prix de Rome in Landscape Architecture—a prize awarded annually to any graduate landscape architect in the United States affording two years advanced study in Europe and providing all expenses and residence at the American Academy in Rome. Two recent graduates of the School have won the top academic award in architecture, the Paris Prize, which is a scholarship worth $5,000 for a year's study in Europe and six months in the Western Hemisphere.

The new Department of Product Design, which took its first students in September 1958, will prepare graduates to work as resident designers with the furniture manufacturers and other essential and important industries of the State. The graduates of the new department will also be qualified to establish offices as professional industrial designers in the major cities of the State.

ARCHITECTURE

Professors ROY GUSSOW, GEORGE MATSUMOTO
Visiting Professor HORACIO CAMINOS
Associate Professors JOSEPH H. COX, CECIL D. ELLIOTT, CHARLES H. KAHN, DUNCAN R. STUART, EDWARD W. WAUGH
Assistant Professors GEORGE L. BIRELINE, JR., JOHN P. SHAW, FRED M. TAYLOR
Visiting Assistant Professor PAUL M-J. BUISSON
Instructors ROBERT P. BURNS, JOHN HERTZMAN
Librarian MRS. JAMES A. LYONS

			Credits	
1	DN 101, 102	Design I, II	3	3
	DN 111, 112	Descriptive Drawing I, II	2	2
	DN 121, 122	Technical Drawing I, II	3	3
	ENG 111, 112	Composition	3	3
	MA 101, 102	First Year Mathematics for Engineers	5	4
	MS 101, 102 or AS 121, 122	Military Science I or Air Science I	2	2
	PE 101, 102	Physical Education	1	1
			19	18
2	ARC 201, 202	Architectural Design I, II	4	4
	DN 211, 212	Descriptive Drawing III, IV	2	2
	EM 311	Mechanics I (Statics)	0	3
	HI 245, 246	History of Civilization	3	3
	MA 201	Calculus I	4	0
	PY 211, 212	General Physics	4	4
	MS 201, 202 or AS 221, 222	Military Science II or Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			20	19

Summer Requirement: Two weeks on HISTORIC ARCHITECTURE RESEARCH—Field Work.

3	ARC 300	Historic Architecture Research	0	2
	ARC 301, 302	Architectural Design III, IV	6	6
	ARC 312	Materials and Specifications	0	3
	CE 338, 339	Structures I, II	4	4
	DN 311, 312	Advanced Descriptive Drawing I, II	2	2
	DN 321, 322	History of Architecture I, II	3	3
	EM 321	Strength of Materials I	3	0
		Elective	3	0
			21	20

Summer requirement: 10 weeks on approved construction or office project experience.

4	ARC 401, 402	Architectural Design V, VI	6	6
	ARC 421, 422	Structural Design I, II	3	3
	DN 411, 412	Advanced Descriptive Drawing III, IV	2	2
	DN 421, 422	History of Design I, II	3	3
	ME 377, 378	Building Mechanics A, B	3	3
		Elective	3	3
			20	20

DESIGN

5	ARC 501, 502	Architectural Design VII, VIII	7	9
	ARC 511	Professional Practice	2	0
	ARC 531, 532	Structural Design III, IV	2	2
	DN 541	Seminar on Ideas in Design	2	0
	PHI 306	Philosophy of Art	0	3
		Elective	6	6
			19	20

LANDSCAPE ARCHITECTURE

Professors ROY GUSSOW, EDWIN G. THURLOW
Associate Professors JOSEPH H. COX, DUNCAN R. STUART
Visiting Associate Professor LEWIS J. CLARKE
Assistant Professor GEORGE L. BIRELINE, JR.

CURRICULUM

			Credits	
1	DN 101, 102	Design I, II	3	3
	DN 111, 112	Descriptive Drawing I, II	2	2
	DN 121, 122	Technical Drawing I, II	3	3
	ENG 111, 112	Composition	3	3
	MA 101, 102	First Year Mathematics for Engineers	5	4
	MS 101, 102 or AS 121, 122	Military Science I or Air Science I	2	2
	PE 101, 102	Physical Education	1	1
			19	18
2	ARC 201, 202	Architectural Design I, II	4	4
	BO 103	General Botany	4	0
	DN 211, 212	Descriptive Drawing III, IV	2	2
	HI 245, 246	History of Civilization	3	3
	MIG 120	Physical Geology	0	3
	PY 211, 212	General Physics	4	4
	MS 201, 202 or AS 221, 222	Military Science II or Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			20	19

Summer Requirement: 2 weeks Historic Architecture or Landscape Architecture Research—Field work.

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* Six credits of elective will be required in the literature of English and three in the Social Sciences. The remaining twelve hours shall be free electives. Total credits for Bachelor of Architecture—196.

3	ARC 300	Historic Architecture Research	0	2
	DN 311, 312	Advanced Descriptive Drawing I, II	2	2
	DN 321, 322	History of Architecture 1, II	3	3
	HRT 201, 202	Plant Materials	3	3
	LA 301, 302	Landscape Design I, II	5	5
	LA 311, 312	Landscape Construction	4	4
		Elective	3	0
			20	19

Summer Requirement: Ten weeks on approved construction or office project experience.·

4	BO 441	Plant Ecology	3	0
	DN 411, 412	Advanced Descriptive Drawing III, IV	2	2
	DN 421, 422	History of Design I, II	3	3
	LA 401, 402	Landscape Design III, IV	6	6
	LA 421, 422	Planting Design	4	4
		Electives	3	6
			21	21
5	DN 511, 512	Advanced Descriptive Drawing V, VI	2	2
	DN 541	Seminar on Ideas in Design	2	0
	LA 501, 502	Landscape Design V, VI	6	8
	LA 511	Landscape Construction & Professional Practice	4	0
	PHI 306	Philosophy of Art	0	3
		Electives	6	6
			20	19

* Six credits of elective will be required in the literature of English and six in the Social Sciences. The remaining twelve hours shall be free electives. Total Credits for the Bachelor of Landscape Architecture—196.

PRODUCT DESIGN

Associate Professor AUSTIN R. BAER, Head of the Department
Professor ROY GUSSOW
Associate Professors JOSEPH H. COX, DUNCAN R. STUART
Assistant Professor GEORGE L. BIRELINE, JR.
Instructor WILLIAM J. BARON

CURRICULUM

			Credits	
1	DN 101, 102	Design I, II	3	3
	DN 111, 112	Descriptive Drawing I, II	2	2
	DN 121, 122	Technical Drawing I, II	3	3
	ENG 111, 112	Composition	3	3
	MA 101, 102	First Year Mathematics for Engineers	5	4
	MS 101, 102 or AS 121, 122	Military Science I or Air Science I	2	2
	PE 101, 102	Physical Education	1	1
			19	18

			Credits	
2	DN 211, 212	Descriptive Drawing III, IV	2	2
	HI 245, 246	History of Civilization	3	3
	IE 217	Machine Tools	1	0
	IE 218	Metal Forming	0	1
	MA 201	Calculus I	4	0
	PD 201, 202	Product Design & Orientation	4	4
	PSY 200	Introduction to Psychology	0	3
	PY 211, 212	General Physics	4	4
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			21	20
3	CH 101, 103	General Inorganic & Qualitative Chemistry	4	4
	DN 311, 312	Advanced Descriptive Drawing I, II	2	2
	EC 425	Industrial Management	3	0
	EM 311	Mechanics (Statics)	3	0
	EM 312	Mechanics II (Dynamics)	0	3
	EM 321	Strength of Materials I	0	3
	PD 301, 302	Product Design	6	6
	PD 331, 332	Materials and Processes	3	3
			21	21
4	DN 411, 412	Advanced Descriptive Drawing III, IV	2	2
	IE 301	Engineering Economy	2	0
	IE 425	Sales and Distribution Methods	0	2
	PD 401, 402	Advanced Product Design	6	6
	PD 422	Office and Industrial Practice	0	2
	PD 441, 442	Design Analysis	2	2
		Electives	9	6
			21	20
5	DN 511, 512	Advanced Descriptive Drawing V, VI	2	2
	DN 541	Seminar on Ideas in Design	2	0
	PD 501	Advanced Product Design	6	0
	PD 502	Product Design Thesis	0	8
	PSY 441	Human Factors in Equipment Design	0	3
	PSY 464	Visual Perception for Designers	3	0
		Electives	6	3
			19	16

* Six credits will be required in the literature of English and six in the Social Sciences. The remaining twelve hours shall be free electives. Total credits for the Bachelor of Product Design—196.

SCHOOL OF EDUCATION

J. BRYANT KIRKLAND, DEAN

INTRODUCTORY

The maximal social and economic development of the citizenry of North Carolina is dependent to a great extent upon the contributions of its educational institutions. The current and anticipated increase in the population of secondary school age youth necessitates a greater number of competent teachers in the public schools of North Carolina, particularly in the areas of vocational agriculture, industrial arts, industrial education, mathematics and science.

The School of Education comprises the following departments: Agricultural Education, Industrial Arts, Industrial Education, Industrial and Rural Recreation, Mathematics and Science Education, Occupational Information and Guidance, and Psychology.

The Department of Agricultural Education is the only one in this state that prepares teachers of vocational agriculture to conduct organized instructional programs of vocational agriculture for prospective and present farmers.

If the youth of North Carolina, particularly those in the non-farm areas, are to become familiar with the increasingly available occupational opportunities which accompany an industrial expansion and are to be given the training needed for entrance into the industrial occupations of their choice, public schools will need to employ a larger number of competent teachers of Industrial Arts and Industrial Education.

The acute shortage of persons qualified to teach Mathematics and Science in the public schools and the demand for graduates with Mathematics and Science backgrounds in industrial positions have made employment opportunities in these areas very good.

Improved methods in industry and the use of mechanized equipment on farms have resulted in more leisure time on the part of urban and rural workers and their families. The Department of Industrial and Rural Recreation contributes much to a better use of this leisure time by training recreational leaders for the municipalities, industries and rural areas of the state.

The Department of Occupational Information and Guidance provides the public schools with teachers and vocational counselors who render valuable assistance to high school youth in making wise vocational choices.

The Department of Psychology serves the various industries in the state by helping to improve their personnel selection programs and by conducting research designed to ascertain what factors influence efficiency of industrial employees.

The primary purpose of the Departments of Agricultural Education, Industrial Arts, Industrial Education, Mathematics and Science Education is that of preparing students to become teachers in North Carolina's public schools. Satisfactory completion of the curriculum requirements in any of these departments qualifies a graduate to receive an A Grade certificate to teach in his chosen subject matter area.

The curriculum in Industrial and Rural Recreation is designed primarily to prepare students to become leaders of recreation programs in industry, institutions and rural areas.

The Departments of Psychology and Occupational Information and Guidance offer service courses for undergraduate students in the School of Education and other schools. These departments are primarily concerned, however, with offering professional instruction at the graduate level for Industrial Psychologists and Vocational Counselors.

CURRICULAR OFFERINGS AND DEGREES

Upon the satisfactory completion of one of the undergraduate curricula in the School of Education, a student is eligible to receive the degree of Bachelor of Science with the name of his area of specialization: in Agricultural Education, Industrial Arts, Industrial Education, Industrial and Rural Recreation, Mathematics Education and Science Education.

The Master of Agricultural Education, Industrial Arts Education, Industrial Education and Occupational Information and Guidance is awarded to students in Education who meet the general requirements of the Graduate School and the specific requirements of the respective departments in which graduate work is taken. Graduate students enrolled in any of the above departments and Psychology who wish to engage in more concentrated study in their major field of interest and to conduct research in this field may earn a research degree—Master of Science—in their respective department of specialization. The specific requirements for undergraduate and graduate degrees are included in the departmental write-ups on pages 79-93.

AGRICULTURAL EDUCATION

Professor C. C. SCARBOROUGH, *Head of the Department*
Professor Emeritus LEON E. COOK
Professors J. K. COGGIN, J. B. KIRKLAND
Associate Professor G. B. JAMES
Instructors HARRY G. BEARD, JAMES T. HORNER

OBJECTIVES

The Department of Agricultural Education is responsible for supplying the public schools with an adequate number of competent teachers of vocational agriculture. Since most of his work as a teacher of vocational agriculture will be done with farm people, the student planning to teach should have lived on the farm. If he is not farm-reared, he will be expected to secure farm experience before he graduates. Enrollment in vocational agriculture in high school with a good supervised farming program contributes to his preparation for teaching vocational agriculture.

The Agricultural Education department provides professional training for students who plan to teach vocational agriculture in high schools. Some graduates, however, go into other work in agriculture, and others do graduate work in agricultural education.

OPPORTUNITIES

There is a great need for teachers of vocational agriculture in North Carolina, with every indication that the demand will be greater in the future. At present, there are 489 white teachers of vocational agriculture in 99 counties in the state. The program is one of the largest in the United States.

GRADUATE STUDY

The department provides opportunities for fully qualified students to do graduate work in Agricultural Education. Graduate students in this field may qualify for either the Master of Science degree or for the degree of Master of Agricultural Education. Detailed information concerning these degrees may be secured from the Department of Agricultural Education or from the Dean of the Graduate School.

CURRICULUM IN AGRICULTURAL EDUCATION — — — — — — — —

			Credits	
1	AG 101	Agriculture and World Affairs	3	0
	AGE 201	Farm Shop Woodwork	2	0
	AGE 202	Farm Shop Metalwork	0	2
	ED 101	Introduction to Agricultural Education	1	0
	ED 102	Objectives in Vocational Agriculture	0	1
	ENG 111, 112	Composition	3	3
	MA 111	Algebra and Trigonometry	4	0
	PO 201	Poultry Production	0	4
	ZO 101	General Zoology	0	3
	MS 101, 102	Military Science I or		
	or			
	AS 121, 122	Air Science I	2	2
	PE 101, 102	Physical Education	1	1
			16	16
2	AGE 211	Farm Power and Machinery I	0	3
	BO 101, 102	General Botany	3	3
	CH 101	General Inorganic Chemistry	4	0
	CH 203	General and Organic Chemistry	0	4
	EC 201	Economics	0	3
	ED 201	FFA in Vocational Agriculture	0	1
	REC 251	Social Recreation	0	3
	MS 201, 202	Military Science II or		
	or			
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
		History Elective	3	0
		Agriculture Electives	5	0
			18	20
3	AGC 212	Economics of Agriculture	3	0
	AGC 303	Farm Management I	0	3
	ED 313	Organizing Programs of Vocational Agriculture	0	3
	ED 344	Secondary Education	0	2
	PY 211	General Physics	4	0
	PSY 304	Educational Psychology	3	0
	PSY 476	Psychology of Adolescence	0	2
	RS 301	Sociology of Rural Life	3	0
	SOI 200	Soils	4	0
		Agricultural Engineering Elective	0	3
		English Elective	0	3
		Free Electives	3	3
			20	19

4				
	AGE 401	Farm Shop Organization and Management	3	0
	ED 411	Student Teaching in Agriculture	6	0
	ED 412	Teaching Adults	2	0
	ED 413	Teaching Materials	2	0
	ED 420	Principles of Guidance	0	2
	ED 430	Senior Seminar	0	1
	RS 321	Introduction to Social Research	2	0
		Biological Science Elective	0	3
		Agriculture Electives	0	6
		English Elective	0	3
		Political Science Elective	0	3
		Free Electives*	3	3
			18	21

Student Teaching in Fall Semester only.
Summer Practice (2 weeks) is required prior to senior year.
* Students taking advanced ROTC will take 18 hours fall semester; other students will get the 3-hour free elective some other semester.

INDUSTRIAL ARTS

Professor IVAN HOSTETLER, *Head of the Department*
Associate Professor TALMAGE B. YOUNG
Assistant Professors HAL MASSEY, ROBERT T. TROXLER
Instructor ROBERT L. FORD

OBJECTIVES

Industrial Arts comprises that area of education which concerns itself with materials, processes, and products of industry. It is concerned with a study of changes made in materials to make them more useful and with the problems related to these changes. The processes involved in changing these materials to useful products constitute the laboratory work in an Industrial Arts Program.

Students, therefore, should have an active interest in industrial materials, processes, products and problems in such areas as woods, metals, electricity, ceramics, graphic arts and plastics. They should enjoy working with hand and machine tools. A wide range of technical skills, practical experience and a knowledge of labor and labor problems is very important.

The Department of Industrial Arts at North Carolina State College performs two functions: First, it prepares teachers and supervisors of industrial arts for secondary schools, and second, it provides practical training for students interested in technical jobs in industry, such as industrial work in production, personnel, sales, estimating, job training and safety.

OPPORTUNITIES

The opportunities for employment as industrial arts teachers in North Carolina are greater than ever before. Less than one-fourth of the public schools have teachers of industrial arts. The demand for industrial employment is also very great.

GRADUATE STUDY

Opportunities are provided for students fully qualified to do graduate work leading to the degree of Master of Industrial Arts Education or Master of Science in Industrial Arts Education. For additional information regarding graduate study, the Graduate School Catalog should be consulted.

CURRICULUM IN INDUSTRIAL ARTS

			Credits	
1	ENG 111, 112	Composition	3	3
	HI 252	The United States Since 1865	0	3
	IA 100	Introduction to Industrial Arts	1	0
	IA 103, 104	Industrial Arts Drawing	3	3
	IA 107, 108	General Woodwork	3	3
	MA 111	Algebra and Trigonometry	4	0
	MA 122	Mathematics of Finance	0	4
	MS 101, 102	Military Science I		
		or		
	AS 121, 122	Air Science I	2	2
	PE 101, 102	Physical Education	1	1
			17	19
2	CH 101	General Inorganic Chemistry	4	0
	EC 201	Economics	0	3
	ENG 231	Basic Speaking Skills	0	3
	IA 205	Industrial Arts Design	2	0
	IA 206, 207	General Metalwork	3	3
	PS 201	The American Governmental System	3	0
	PY 211, 212	General Physics	4	4
	SOC 202	Man and Society	0	3
	MS 201, 202	Military Science II		
		or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			19	19
3	ED 344	Secondary Education	2	0
	ED 422	Methods of Teaching Industrial Subjects	0	4
	IA 304	General Shop Organization	0	2
	IA 306	Graphic Arts	0	3
	IA 307	General Electricity	3	0
	IA 308	Industrial Arts Electronics	0	3
	IA 320	Tools and Materials	2	0
	PSY 304	Educational Psychology	3	0
	PSY 476	Psychology of Adolescence	0	2
		English Elective	3	0
		Electives	6	3
			19	17
4	ED 420	Principles of Guidance	0	2
	ED 424	Occupational Studies	0	2
	ED 444	Student Teaching in Industrial Subjects	6	0
	ED 482	Curriculum Problems in Industrial Arts	2	0
	ED 483	Instructional Aids and Devices	2	0
	IA 315	General Ceramics	0	3
	IA 460	General Shop	3	0
	IA 484	School Shop Planning & Equipment Selection	3	0
		Electives	3	12
			19	19

CURRICULUM IN INDUSTRIAL ARTS—TECHNICAL OPTION

Freshman and Sophomore Years Same as in Industrial Arts Education

3	EC 202	Economics	3	0
	IA 307	General Electricity	3	0
	IA 308	Industrial Arts Electronics	0	3
	IA 321	Metalwork Technology	0	2
	IE 310	Industrial Safety	2	0
	IE 332	Motion and Time Study	4	0
	PSY 200	Introduction to Psychology	3	0
	PSY 337	Industrial Psychology I	0	3
	SOC 301	Human Behavior	0	3
		English Elective	0	3
		Electives	3	6
			18	20
4	EC 425	Industrial Management	3	0
	EC 426	Personnel Management	0	3
	EC 432	Industrial Relations	3	0
	ED 424	Occupational Studies	0	2
	IA 320	Tools and Materials	2	0
	IA 580	Modern Industries	0	2
	IE 408	Production Control	3	0
	IE 430	Job Evaluation and Wage Administration	0	3
		Electives	6	9
			17	19

INDUSTRIAL EDUCATION

OBJECTIVES

The Department of Industrial Education is the only one in the state that prepares teachers of Industrial Education for the public schools. The main goal is to provide public schools with adequately trained personnel who can, in turn, help to develop a vitally needed reservoir of skilled workers and technical personnel to man established industries as well as prepare for new industries. The curriculum is planned to provide students with broad cultural and professional backgrounds to parallel occupational experience.

Candidates for a degree must have had at least two years of successful trade experience in the trade they wish to teach. The student who has not had this trade experience when he enters must fulfill the requirement before graduation either by working part of the school year or by completing the work experience after finishing the required resident courses.

OPPORTUNITIES

The student who completes this curriculum will be prepared to teach in the all-day trade schools, area vocational schools and the part-time, or evening vocational classes. Graduates have no difficulty in obtaining employment as Industrial Education teachers.

GRADUATE STUDY

General and specialized professional courses are available to qualified students who wish to pursue graduate study as Industrial Education teachers, supervisors or coordinators of diversified occupations. The com-

pletion of the Master of Industrial Education or Master of Science degree in Industrial Education will also qualify one for a Graduate Certificate in North Carolina.

CURRICULUM IN INDUSTRIAL EDUCATION — — — — — — — — —

A minimum of 148 semester credits required for graduation

			Credits	
1	ED 100	Introduction to Industrial Education	2	0
	ENG 111, 112	Composition	3	3
	HI 252	The United States Since 1865	0	3
	IA 103, 104	Industrial Arts Drawing	3	3
	MA 111	Algebra and Trigonometry	4	0
	MA 122	Mathematics of Finance	0	4
	MS 101, 102	Military Science I		
	or	or		
	AS 121, 122	Air Science I	2	2
	PE 101, 102	Physical Education	1	1
		Electives*	2	3
			17	19
2	CH 101	General Inorganic Chemistry	4	0
	EC 201	Economics	0	3
	ENG 231	Basic Speaking Skills	3	0
	PS 201	American Governmental System	3	0
	PY 211	General Physics	0	4
	SOC 202	Man and Society	3	0
	SOC 301	Human Behavior	0	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
		Electives*	3	6
			19	19
3	EC 202	Economics	3	0
	EC 312	Accounting for Engineers	0	3
	ED 308	Visual Aids	0	2
	ED 344	Secondary Education	2	0
	ED 422	Methods of Teaching Industrial Subjects	0	4
	IE 310	Industrial Safety	2	0
	PSY 304	Educational Psychology	3	0
	PSY 476	Psychology of Adolescence	0	2
	REC 333	First Aid and Safety	2	0
		English Elective	0	3
		Electives	7	3
			19	17

4	ED 420	Principles of Guidance	0	2
	ED 440	Vocational Education	2	0
	ED 444	Student Teaching in Industrial Subjects	6	0
	ED 483	Instructional Aids and Devices	2	0
	ED 516	Community Occupational Surveys	0	2
	ED 524	Occupational Information	0	2
	ED 525	Trade Analysis and Course Construction	2	0
	ED 527	Philosophy of Industrial Education	0	2
	PSY 337	Industrial Psychology	0	3
		Electives*	6	8
			18	19

* Electives to be selected with aid of advisor to meet special needs of individual students.

INDUSTRIAL AND RURAL RECREATION

Professor THOMAS I. HINES, *Head of Department*
Associate Professor LATHAM L. MILLER
Assistant Professors CHARLES C. STOTT, ALBERT CRAWFORD

OBJECTIVES

The Department of Industrial and Rural Recreation provides training for students who plan to become recreation leaders in industry, municipalities, institutions and rural communities. The recreation profession recognizes the importance of leaders who possess the competence needed to plan and supervise effective recreation programs. Competent leadership is the major factor affecting the scope, intensity and success of a program of organized recreation. A curriculum in Park Administration is also offered for students who plan to engage in the administration of local, county or state parks.

All students pursue the same program for the first year after which they declare an option (Employee, Public, Institutional or Park Administration) and take courses designed to meet the needs in their respective area of specialization.

OPPORTUNITIES

The demand for properly trained recreation leadership has increased rapidly in recent years. The number of graduates has not been sufficient to meet the demand for recreation leaders.

CURRICULUM OF INDUSTRIAL AND RURAL RECREATION

A minimum of 149 semester credits required for graduation.

			Credits	
1	ENG 111, 112	Composition	3	3
	HI 252	U. S. History Since 1865	3	0
	MA 111	Algebra and Trigonometry	4	0
	PS 201	American Governmental System	0	3
	REC 152	Introduction to Recreation	3	0
	REC 153	Aquatic Sports	0	2
	SOC 202	Man and Society	0	3
	ZO 101, 102	General Zoology	3	3
	MS 101, 102	Military Science I		
	or			
	AS 121, 122	Air Science I**	2	2
	PE 101, 102	Physical Education**	1	1
			19	17

CURRICULUM IN RECREATION ADMINISTRATION — — — — — — —

1 For Freshman year see page 85.

			Credits	
2	EC 201, 202	General Economics	3	3
	ENG 215	Principles of News and Article Writing	0	3
	ENG 231	Basic Speaking Skills	3	0
	REC 201	Playground Leadership	2	0
	REC 251	Social Recreation I	3	0
	REC 252	Social Recreation II	0	3
	REC 253	Principles of Physical Education	0	3
	SOC 301	Human Behavior	0	3
	ZO 212	Human Anatomy	3	0
	ZO 213	Human Physiology	0	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II**	2	2
	PE 201, 202	Physical Education**	1	1
			17	21
3	MA 122	Mathematics of Finance		
	or			
	EC 312	Accounting for Engineers	0	4
	PSY 200	Introduction to Psychology		
	or			
	PSY 304	Educational Psychology	3	0
	REC 333	First Aid and Safety	2	0
	REC 351	Individual Sports in Recreation	3	0
	REC 352	Team Sports in Recreation	0	3
	REC 353	Camp Organization and Leadership	0	3
	REC 354	Personal and Community Hygiene	3	0
		Electives*	8	11
			19	21
4	REC 451	Facilities and Equipment	3	0
	REC 452	Recreation Administration	3	0
	REC 470	Supervised Practice	0	6
	REC 471	Organizing the Recreation Program	2	0
	REC 472	Observation and Field Experience	0	2
		Electives*	10	9
			18	17

* At the end of the sophomore year, a student must select an area of special interest. At least 24 semester hours of course work must be taken from the list of elective courses in the chosen area.

** Students excused from Military or Air Science and/or Physical Education will schedule equivalent credits in courses from the following departments: Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Psychology, Rural Sociology, Social Studies and Sociology.

Field Work: Evidence of at least four months of satisfactory experience in the practice of his profession is required for graduation.

Elective Courses

Employee Recreation	EC 319	Money and Banking	3
	EC 401	Principles of Accounting	3
	EC 402	Principles of Accounting	3
	EC 407	Business Law I	3
	EC 411	Marketing Methods	3
	EC 412	Sales Management	3
	EC 420	Corporation Finance	3
	EC 425	Industrial Management	3
	EC 426	Personnel Management	3
	EC 431	Labor Problems	2
	EC 432	Industrial Relations	2
	ED 308	Visual Aids	2
	PSY 302	Psy. of Personality and Adjustment	3
	PSY 337	Industrial Psychology I	3
	PSY 438	Industrial Psychology II	3
	PSY 490	Social Psychology	3
	REC 401	Principles & Practice of Industrial Recreation	2
	SOC 302	Public Relations in Modern Society	3
	SOC 501	Leadership	3
Public Recreation	ED 308	Visual Aids	2
	ED 420	Principles of Guidance	2
	IA 314	Recreation Arts & Crafts	2
	PS 202	County and Municipal Government	3
	PS 502	Public Administration	3
	PSY 476	Psychology of Adolescence	2
	REC 207	History and Principles of Park Administration	2
	REC 301	Organization and Administration of Physical Education	2
	REC 315	Prevention and Care of Athletic Injuries	2
	REC 325	Activities for the Handicapped Individual	2
	REC 411	Park Maintenance and Operation I	2
	REC 412	Park Maintenance and Operation II	2
	SOC 302	Public Relations and Modern Society	3
	SOC 305	Race Relations	3
	SOC 402	City Life	3
	SOC 411	Community Relationships	3
	ZO 312	Principles of Game Management	3
Institutional Recreation	ED 308	Visual Aids	2
	IA 314	Recreation Arts and Crafts	2
	PHI 305	Philosophy of Religion	3
	PS 202	County and Municipal Government	3
	PS 502	Public Administration	3
	PSY 302	Psychology of Personality and Adjustment	3
	PSY 307	General Applied Psychology	2
	PSY 476	Psychology of Adolescence	2

PSY 490	Social Psychology	3
PSY 530	Abnormal Psychology	3
REC 301	Organization and Administration of Physical Education	2
REC 315	Prevention and Care of Athletic Injuries	2
REC 325	Activities for Handicapped Individuals	2
SOC 302	Public Relations and Modern Society	3
SOC 304	Contemporary Family Life	3
SOC 306	Delinquency and Crime	3
SOC 412	Introduction to Social Work	3

CURRICULUM IN PARK ADMINISTRATION

1 For Freshman year see page 85.

			Credits	
2	BO 101, 102	General Botany	3	3
	EC 201, 202	General Economics	3	3
	ENG 215	Principles of News & Article Writing	0	3
	ENG 231	Basic Speaking Skills	3	0
	PS 202	County and Municipal Government	0	3
	PSY 200	Introduction to Psychology	0	3
	REC 207	History & Prin. of Park Administration	2	0
	REC 251	Social Recreation I	3	0
	REC 333	First Aid and Safety	2	0
	ZO 252	Ornithology	0	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II**	2	2
	PE 201, 202	Physical Education**	1	1
			19	21
3	AGE 201	Farm Shop Wood Work	2	0
	AGE 202	Farm Shop Metal Work	0	2
	BO 211	Dendrology	2	0
	BO 403	Introduction to Systematic Botany	0	3
	MA 122	Mathematics of Finance		
	or	or		
	EC 312	Accounting for Engineers	0	4
	MIG 120	Physical Geology	0	3
	PSY 302	Psychology of Personality and Adjustment	3	0
	REC 351	Individual Sports in Recreation	3	0
	REC 352	Team Sports in Recreation	0	3
	ZO 321	Wildlife and Natural Resource Conservation	0	3
		Electives	6	3
			16	21

4	AGE 341	Farm Electrification and Utilities	3	0
	BO 441	Plant Ecology	3	0
	EC 426	Personnel Management	0	3
	REC 353	Camp Organization and Leadership	3	0
	REC 354	Personal and Community Hygiene	3	0
	REC 411, 412	Park Maintenance and Operation	2	2
	REC 451	Facilities and Equipment	0	3
	REC 452	Recreation Administration	3	0
	REC 471	Organizing the Recreation Program	0	2
	ZO 522	Animal Ecology	0	3
		Electives	3	3
			20	16

** Students excused from Military or Air Science and/or Physical Education will schedule equivalent credits in courses from the following departments: Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Psychology, Rural Sociology, Social Studies and Sociology.

Field Work: Evidence of at least four months of satisfactory experience in the practice of his profession is required for graduation.

MATHEMATICS AND SCIENCE EDUCATION

Assistant Professor HERBERT E. SPEECE, *Head of the Department*

OBJECTIVES

The Department of Mathematics and Science Education offers curricula for those students who wish to become teachers of Mathematics or Science. Each curriculum provides for a well rounded professional preparation. There is sufficient flexibility in each curriculum to enable the student to meet certification requirements in both subject matter areas by proper selection of elective courses. This flexibility also enables the student to specialize in one subject matter area thus opening up job opportunities in related fields requiring a substantial background in Mathematics and Science, such as research teams in industry, government research projects involving rockets, guided missiles, computers or pure research.

OPPORTUNITIES

The acute shortage of Mathematics and Science teachers in the secondary schools provides excellent employment opportunities for more graduates in this department. Attractive job opportunities are also available for industrial employment. The rapid technological and scientific developments during the past few years have accentuated the importance of mathematics and science. Future developments will depend upon the accomplishments of persons who have received adequate training in these areas.

CURRICULUM IN MATHEMATICS EDUCATION

A minimum of 144 credits required for graduation

			Credits	
1	CH 101	General Inorganic Chemistry	4	0
	CH 103	General and Qualitative Chemistry	0	4
	ENG 111, 112	Composition	3	3
	HI 252	The United States since 1865	3	0
	MA 101, 102	First Year Mathematics for Engineers	5	4
	PS 201	The American Governmental System	0	3
	MS 101, 102	Military Science I		
	or	or		
	AS 121, 122	Air Science	2	2
	PE 101, 102	Physical Education	1	1
			18	17

EDUCATION

			Credits	
2	ED 203	Introduction to Teaching	2	0
	IA 103	Industrial Arts Drawing	3	0
	MA 201, 202	Calculus I, II	4	4
	PY 211, 212	General Physics	4	4
	SOC 202	Man and Society	0	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
		Electives*	3	5
			19	19
3	CE 201	Surveying or		
	PY 223	Astronomy	0	3
	EC 201, 202	Economics	3	3
	ED 308	Visual Aids	0	2
	ED 344	Secondary Education	0	2
	MA 122	Mathematics of Finance	4	0
	PSY 304	Educational Psychology	3	0
		English Electives*	3	3
		Electives*	5	6
			18	19
4	ED 420	Principles of Guidance	0	2
	ED 470	Methods of Teaching Mathematics	3	0
	ED 471	Student Teaching in Mathematics**	10	0
	MA 533	History of Mathematics	0	3
	PSY 476	Psychology of Adolescence	2	0
		Electives*	3	11
			18	16

* A minimum of 6 semester hour electives in mathematics and 4 semester hours in mathematics and science. All electives must be selected with approval of adviser.

** During the fall semester of the Senior year 12 weeks will be devoted to full-time off-campus work at an approved Student Teaching Center and approximately 6 weeks to concentrated courses.

CURRICULUM IN SCIENCE EDUCATION

A minimum of 144 credits required for graduation

			Credits	
1	BO 101, 102	General Botany	3	3
	ENG 111, 112	Composition	3	3
	HI 252	The United States since 1865	3	0
	MA 111	Algebra and Trigonometry	4	0
	MA 112	Analytic Geometry and Calculus A	0	4
	MIG 120	Physical Geology	0	3
	MS 101, 102	Military Science I		
	or	or		
	AS 121, 122	Air Science I	2	2
	PE 101, 102	Physical Education	1	1
			16	16

			Credits	
2	CH 101	General Inorganic Chemistry	4	0
	CH 103	General and Qualitative Chemistry	0	4
	ED 203	Introduction to Teaching	2	0
	PS 201	The American Governmental System	3	0
	SOC 202	Man and Society	0	3
	ZO 101, 102	General Zoology	3	3
	ZO 213	Human Physiology	0	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
		Electives*	4	3
			19	19
3	CH 203	General and Organic Chemistry	4	0
	EC 201, 202	Economics	3	3
	ED 308	Visual Aids	0	2
	ED 344	Secondary Education	2	0
	ENT 312	Economic Entomology	0	3
	PSY 304	Educational Psychology	0	3
	PY 211, 212	General Physics	4	4
		English Elective	3	0
		Electives*	3	4
			19	19
4	BO 312	General Bacteriology	0	4
	ED 420	Principles of Guidance	0	2
	ED 475	Methods of Teaching Science	3	0
	ED 476	Student Teaching in Science**	10	0
	PSY 476	Psychology of Adolescence	2	0
		English Elective	0	3
		Electives*	3	9
			18	18

* All electives to be selected with approval of adviser.

** During the fall term of the Senior year, 12 weeks will be devoted to full-time off-campus work at an approved Student Teaching Center and approximately 6 weeks to concentrated courses on the campus.

— — — OCCUPATIONAL INFORMATION AND GUIDANCE

Professor ROY N. ANDERSON, *Head of the Department*

Associate Professor CHARLES G. MOREHEAD

— — — — — — — — — — — — — — — — — — OBJECTIVES

Special facilities are provided in the School of Education for mature students and individuals who have had teaching or personnel experience and who hold a Bachelor's degree to enroll for courses leading to a Master's degree in Occupational Information and Guidance, or a Master of Science degree. The offerings of the Department of Occupational Information and Guidance permit graduate students in subject-matter fields to

select appropriate courses which will enable them to provide guidance and counseling for their students as well as exert influence in promoting a school-wide guidance program.

A special program in rehabilitation counseling has been made possible by a Grant from the Office of Vocational Rehabilitation of the Department of Health, Education and Welfare.

In addition to the graduate program, the Department provides instruction in guidance for undergraduate students in the School of Education.

OPPORTUNITIES

Graduate work in Occupational Information and Guidance gives preparation for such positions as counselor in secondary schools, colleges or community agencies; school guidance director; employment counselor; placement worker; business or industrial personnel worker; and for personnel work in the State or Federal Government. Administrators, supervisors, directors of instruction and others who wish to prepare themselves for positions of leadership in guidance work may also profit from this program.

The Federal-State Rehabilitation program is expanding and there is a definite demand for rehabilitation counselors today. This demand is expected to increase in the near future.

GRADUATE STUDY

The Master's program includes a core of Guidance courses as follows: ED 524, Occupational Information; ED 631, Education and Vocational Guidance; ED 633, Techniques in Guidance and Personnel; ED 641, Field Work; and ED 651, Research. Opportunity for field work is available in secondary schools, colleges, clinics, employment offices and other agencies, according to the student's interest. Special courses are provided for rehabilitation counselors. Courses in Psychology, Sociology, Economics and Education are selected to round out the program. For those interested in public school guidance work, the program also meets the requirements for the Counselors Certificate issued by the State Department of Public Instruction, as well as similar certificates in many other states.

PSYCHOLOGY

Professor HOWARD G. MILLER, *Head of the Department*
Professors KEY L. BARKLEY, HAROLD M. CORTER
Visiting Professor WILLIAM MCGEHEE
Associate Professors J. CLYDE JOHNSON, PAUL J. RUST
Assistant Professors WILLIAM B. ASKREN, MICHAEL D. CAFFEY, JOHN O. COOK, SLATER E. NEWMAN
Instructor CLIFTON W. GRAY

OBJECTIVES

In general, the courses in Psychology are designed to promote a broad understanding of man in relation to his environment and to cultivate the skills which may be useful in dealing with human beings in social, educational, industrial or other practical situations.

The Department of Psychology is located in the School of Education. The Department, however, offers courses of interest to students in all the professional schools.

The primary objectives of the Department are: to provide students with a broad and general understanding of human development, behavior and adjustment; to provide students in the various technical departments with the specialized instruction which will be of practical value to them; to

give instruction in the areas of child development, motivation, learning, social development and efficiency of study to students who are preparing to be teachers; to provide comprehensive training in industrial psychology and allied areas to students at the graduate level.

The Department has special facilities and arrangements for conducting its work which aid in the achievement of the stated objectives.

In order to provide psychological services to industry, the Department has established an Industrial Psychology Center which is equipped to conduct personnel evaluations, employee counseling, personnel training, aptitude testing, attitude surveys, personnel research and other psychological services.

In addition to the regular College budget, the Department has a psychology research budget which incorporates contract research studies sponsored by industrial firms, private organizations, and government agencies.

An applied Experimental Psychology Laboratory has been established in the Department. Emphasis is placed upon the design of experiments to study practical human problems. The design of machines to fit the human operator and the planning of work tasks in accordance with human capacities and limitations are major areas of concern in the Laboratory.

OPPORTUNITIES

The Department does not offer an undergraduate degree in Psychology, but a student may elect courses to the extent time is allowed by his regular curriculum. The Department does give a Master of Science Degree in Industrial Psychology.

Upon completion of the Master's Degree in Industrial Psychology, a student may find employment in business or industry particularly in personnel work but also in general management. Some students become research workers in government or private organizations. Opportunities are available also in teaching and research activities in colleges and universities. Many students continue work toward the doctorate in other universities.

GRADUATE STUDY

The emphasis in graduate study in the Department is upon Industrial Psychology. A required basic set of courses is provided for all students who wish to work toward a Master's Degree in Industrial Psychology. Supporting courses are offered in sufficient number for students to have some latitude in their emphasis on minor lines of study. The graduate courses in the Department are also available to graduate students majoring in Agricultural Education, Guidance, Industrial Arts, Industrial Education, Mathematics and Science Education, Textiles, Industrial Engineering, Rural Sociology and Statistics.

For general regulations regarding graduate study, the Graduate School Catalog should be consulted.

SCHOOL OF ENGINEERING

JOHN HAROLD LAMPE, DEAN
ROBERT G. CARSON, DIRECTOR OF INSTRUCTION
W. E. ADAMS, COORDINATOR OF STUDENT AFFAIRS

INTRODUCTORY

The impact of science and technology on civilization imposes upon all of us, and upon the engineer in particular, a new sense of responsibility. The scientist cannot guarantee that his contributions will always be used for noble purposes: he cannot answer for the misuse of scientific discoveries by dictators who would enslave the human race. But he can supply the knowledge and tools for building a better world and the defenses for its preservation. To be an engineer thus carries with it the responsibility and the obligation to use all newly discovered knowledge for the benefit of mankind. Discovery leads to discovery; knowledge opens the way to more knowledge, making possible further enlightenment and a new age of plenty.

Engineering studies are of the utmost interest and importance to those young men and women who look to industry, engineering, or research for a career. These ambitions can well be furthered by the School of Engineering through its undergraduate or graduate programs, whereby students are offered technical instruction and leadership guidance by an experienced staff of qualified engineers and educators.

The School of Engineering is organized into ten engineering departments: Chemical, Civil, Electrical, Industrial, Mechanical, Physics, Mathematics, Mineral Industries, Mechanics and Research. Undergraduate degree programs are offered in the first eight named departments, and all the teaching departments offer advanced studies leading to a Professional Degree or to the Master's degree. The Doctor of Philosophy program is offered in the Ceramic, Chemical, Civil, Electrical, and Physics Departments.

It is the policy of the School of Engineering to have all its curricula more than meet the standards of the Engineers' Council for Professional Development. It is the ambition of the School that its curricula and programs meet the needs of the people and industries of the state and region through effective instruction, competent research and development, and worthwhile scientific contributions to engineering knowledge.

CURRICULA

The curricula representing the study program in all of the departments are so arranged that the freshman year is common to all. They contain broadening courses in the humanities while emphasizing the basic and fundamental engineering principles so essential to an engineering college program. Graduates of this program will not only be prepared for engineering responsibilities and positions of trust in industry, but will also have an appreciation and consciousness of human problems in community and industrial life. Though an entering student is asked to designate a field of interest, he can with ease and without any interruption change to some other field of study within the School of Engineering at the end of the freshman year.

FOUR-YEAR BACHELOR'S CURRICULA AND PROFESSIONAL (FIFTH YEAR) STUDY

The four-year program provides education and training to meet the needs of from eighty to eighty-five per cent of the young men of North Carolina who will take their places in industry and industrial life in the fields of production, sales, application, planning and the operation of small industrial units.

The fifth-year specialized training leads to a professional degree (CE, CHE, ME, EE, etc.) in ceramic, chemical, civil, electrical, geological, industrial and mechanical engineering. The courses of study are especially designed to meet the needs of students desiring intensive specialization in a particular field or additional course work not ordinarily covered in the normal four-year undergraduate curricula.

GRADUATE STUDY

The graduate activities are patterned to provide advanced training and experience to young men who have successfully completed a four-year program and who have an interest and ability to continue their education. This elective program will train graduates for positions and activities in teaching, technical design and research. The Engineering School offers two programs of graduate study. The first represents a year of full-time study and thesis work and leads to a degree of Master of Science in some field of engineering. The second program leads to a Doctor's degree in some field of engineering and usually requires three years of full-time study, thesis work and experimental activity.

RESEARCH

Research activities in the School of Engineering are based on a program correlated with graduate study in engineering. It is the purpose of this program not only to train future research workers, but also to carry out a program that assures both sound investigations of a fundamental nature in engineering sciences and work devoted to greater uses of the State's natural resources. Through publication, cooperative activity with industry and the operation of our own investigational projects, it is intended that the engineering research activities will be a part of and work effectively with the industrial development of North Carolina.

DEGREES

BACHELOR OF ENGINEERING

The four-year curricula offer programs of study leading to a Bachelor's degree in Agricultural, Ceramic, Chemical, Civil, Engineering Mathematics and Engineering Physics, Geological, Industrial, Mechanical and Nuclear Engineering. Aeronautical Engineering is an option in Mechanical Engineering, and Construction Engineering is an option in Civil Engineering. Graduation requirements are the satisfactory completion of all the required courses in any one curriculum and other courses which amount to a minimum of 150 semester credit hours. A minimum scholastic record of a C average is also required. A minimum of six weeks' summer employment is required in all curricula.

BACHELOR OF SCIENCE IN A SPECIALIZED BRANCH OF ENGINEERING

This is an earned undergraduate degree and is available through programs of study in Furniture Manufacture and Management and in Heating and Air Conditioning. The course is planned for four years of study. Graduation requirements are the satisfactory completion of all the required

courses in any one curriculum and other courses which amount to a minimum total of 150 semester credit hours. A minimum scholastic record of C average is also required. Other requirements are the satisfactory completion of a week's inspection trip in the senior year and a minimum of six weeks' summer employment.

PROFESSIONAL DEGREE IN A SPECIALIZED BRANCH OF ENGINEERING

This is an earned degree which can be obtained only after the Bachelor's degree. The fifth-year curricula are especially designed to meet the needs of students desiring intensive specialization in a particular field or additional course work not ordinarily covered in the normal four-year undergraduate curricula. This professional program of study is offered in Ceramic, Chemical, Civil, Electrical, Geological, Industrial and Mechanical Engineering. Regulations covering this degree are shown on pages 130-131.

For further information concerning the requirements for the professional degree, applications for admission, etc., address Dr. J. H. Lampe, Dean of Engineering, North Carolina State College, Raleigh, North Carolina.

MASTER OF SCIENCE (M.S.) IN A SPECIALIZED BRANCH OF ENGINEERING

This is an earned graduate degree which can be obtained only after the Bachelor's degree. It requires at least one year of graduate work, a reading knowledge of at least one foreign language and a thesis showing ability to pursue independent research. The core of graduate courses taken must emphasize a scientific objective. Further information concerning the requirements for this degree may be obtained by addressing Director of Graduate Studies, State College, Raleigh, North Carolina.

DOCTOR OF PHILOSOPHY DEGREE (Ph.D.)

This is an earned graduate degree offered in Ceramic, Chemical, Civil, Electrical, and Nuclear Engineering and Engineering Physics. Admission requirements are the same as for the master's degree. It requires at least two years of graduate work with a major in Ceramic, Chemical, or Electrical Engineering and a minor either in some field of engineering or in an allied science. The dissertation will also deal with some problem in the field of the student's major interest. Inquiries about this program should be addressed to Director of Graduate Studies, State College, Raleigh, North Carolina.

THE HONORARY DEGREE OF DOCTOR OF ENGINEERING (D.Eng.)

This degree is purely an honorary degree conferred upon men of extraordinarily high professional engineering attainments who are graduates of one of the branches of the University of North Carolina, or upon professional engineers who have rendered distinguished services to the State of North Carolina.

NON-SCHOLASTIC REQUIREMENTS

SUMMER WORK: INDUSTRIAL EMPLOYMENT

A minimum of six continuous weeks of gainful employment is a specific requirement for graduation in Engineering. This employment may be as laborer, sub-professional, or professional assistant in any of the following fields: (1) industrial manufacture, repair service, or sales; (2) industrial engineering or scientific research; (3) engineering or architectural design and drafting; (4) engineering exploration, surveying, or reconnaissance; (5) construction of buildings, roads, railroads, dams and other engineering works.

Students are required to consult with their department heads as to the type of work that will be acceptable before making arrangements for industrial employment. It is desirable that this employment be in the student's scholastic major. The required industrial employment should be completed during the summer vacation period, which may be the one between the sophomore and junior years or the one between the junior and senior years, preferably the latter. Students enrolled for advanced military training should complete the industrial employment requirement between the sophomore and junior years to avoid conflict with ROTC Summer Camp.

The student is responsible for obtaining his employment and supplying satisfactory evidence thereof to the head of his department. This evidence will consist of a letter from the employer to the head of the student's department setting forth (1) inclusive dates of employment; (2) character of work performed; (3) type of operation of firm or individual; (4) an evaluation of the student's work. This letter must be submitted to the department head not later than the end of the fall semester of the year in which the student intends to graduate.

SHORT COURSES AND INSTITUTES

The School of Engineering cooperates with the College Extension Division in offering short courses and institutes both on the campus and at various centers throughout the State for adults and graduate engineers. Such courses vary in length from one day to twelve weeks; each year the courses offered are different and vary according to the public demand. The faculty of the School of Engineering usually furnish a large portion of the instruction offered in these courses, which in the past have been for Electrical Metermen, Gas Plant Operators, Safety Engineers, Radio Engineers, Refrigeration and Air Conditioning Engineers, Waterworks Operators, Heating and Plumbing Contractors and Surveyors. Classes are usually held in Raleigh where the School of Engineering has an excellent staff and adequate laboratories and classroom facilities available.

These short courses offer real opportunity to practicing engineering personnel to follow a refresher program in their field of interest, as well as to become acquainted with the latest and most modern engineering procedures and equipment.

Another educational services activity is that being carried out at the Gaston Technical Institute, Gastonia, North Carolina, where a two-year post-high school terminal technician program is sponsored by the School of Engineering and operated by the Extension Division of the College. A separate full-time staff is employed for this educational program which provides an integrated curriculum in English, mathematics, engineering drawing, machine shop, welding, electrical maintenance and economics. Graduates of this program are trained for industry with the opportunity for rapid acceleration towards positions of foremen, maintenance supervisors, etc.

CURRICULA OFFERED IN THE SCHOOL OF ENGINEERING

Each of the following curricula is not only well-balanced, but offers a liberal course of study in a technical and professional field. Each conforms to what is regarded by engineering educators as the best modern practice.

FOR ALL ENGINEERING CURRICULA

			Credits	
1	**CH 101, 103**	**General Inorganic Chemistry and Qualitative Analysis**	**4**	**4**
	ENG 111, 112	**Composition**	**3**	**3**
	E 100	**Introduction to Engineering**	**1**	**0**

HI 205	The Modern Western World	0	3
MA 101, 102**	First Year Mathematics for Engineers	5	4
ME 101, 102	Engineering Graphics I, II	2	2
MS 101, 102 or AS 121, 122	Military Science or Air Science	2	2
PE 101, 102	Physical Education*	1	1
		18	19

* Students excused from Military Science or Air Science and/or Physical Education will schedule equivalent credits in courses outside their department.

** To be eligible to roster courses taught by the School of Engineering above the freshman level, an engineering student must have earned a minimum grade of "C" on MA 102.

The sophomore, junior and senior programs of study in the various fields of Engineering are shown under the department headings on the pages that follow.

HUMANITIES—SOCIAL STUDIES PROGRAM FOR ENGINEERING STUDENTS

A specially designed sequence of courses comprising twenty-one (21) credit hours is required of all engineering students and is incorporated in each curriculum. Its primary objective is to broaden the student in the humanities and social sciences and to instill good habits in the use of the English language. Following a broad yet basic consideration of history, economics and literature, the student progresses to an advanced and integrated study of contemporary civilization and of contemporary problems. The work of the last semester may be chosen from a group of approved electives which are built upon and closely related to the subject matter of the previous three years.

FRESHMAN YEAR

		Credits	
HI 205 / EC 205	The Modern World or The Economic Process	0	3
SOPHOMORE YEAR			
HI 205 / ENG 205*	The Modern World and Reading for Discovery	3	3
EC 205	or The Economic Process		
JUNIOR YEAR			
SS 301, 302	Contemporary Civilization	3	3
SENIOR YEAR			
SS 491	Contemporary Issues I and Approved Elective (see list below)	3	3

SENIOR ELECTIVES FOR HUMANITIES—SOCIAL STUDIES PROGRAM

SS 492	Contemporary Issues II	3
HI 412	Recent United States History	3
ENG 366	The American Mind	3
PS 401	American Parties and Pressure Groups	3
SOC 401	Human Relations in Industrial Society	3
PHI 395	Philosophical Analysis	3
EC 442	Evolution of Economic Ideas	3

* History, Economics, and Literature may be scheduled in any order except that ENG 111, 112, Composition, are prerequisite for ENG 205. Only one course can be scheduled without special permission.

Courses from the approved list of senior electives will not be credited to the humanities sequence unless preceded by all other required humanities courses.

AGRICULTURAL ENGINEERING

A curriculum for work leading to the Bachelor's degree in Agricultural Engineering is the joint responsibility of the School of Agriculture and the School of Engineering. Each of the schools gives approximately one-half the course work.

For further details concerning the field, see page 42.

CHEMICAL ENGINEERING

Professor E. M. SCHOENBORN, *Head of the Department*
Professors K. O. BEATTY, JR., F. P. PIKE
Associate Professors R. BRIGHT, J. F. SEELY
Assistant Professor E. R. CONWAY

OBJECTIVES

Chemical Engineering is concerned with the development and application of manufacturing and allied processes in which chemical or certain physical changes of material are involved. It involves the application of mathematics, chemistry, physics, and fundamental engineering principles to the design, construction, operation, control, and improvement of equipment for carrying out chemical processes on an industrial scale at the lowest possible cost. Most of the so-called process industries—the production of chemicals, plastics, rubber, paints, synthetic fibers, petroleum, paper, explosives, drugs, food, soap, magnesium, aluminum, glass, cement and numerous others—are inherently chemical engineering in nature. To prepare men for careers in industries of these kinds is the purpose of the course in Chemical Engineering.

CURRICULUM

The work of the chemical engineer is so extensive and diversified in scope that his training must be along broad and basic lines rather than in any one field of specialization. Furthermore, the spirit of research and experimentation is vital to the chemical industry so that the development not only of a sound technical background but also of a capacity for original thought and independent accomplishment is an essential part of his program. The undergraduate curriculum emphasizes the engineering, the chemical, and the 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 in the first three years with the exception of a reduction of time devoted to laboratory work. The subjects in mechanical and electrical engineering, in mechanics and metallurgy are designed to supply the fundamentals of these branches. The work in the Chemical Engineering subjects, although distinctly professional in application, is nevertheless basic in character. Since it depends upon a thorough background in the sciences, it is postponed until the third and fourth years. It is designed to develop initiative, sound habits of thought, and intellectual curiosity in the student.

FACILITIES

The Chemical Engineering Laboratories are provided with pilot plant-type equipment for studying the principles of fluid flow, heat transfer, distillation, absorption, drying, crushing and grinding, filtration, agitation, etc. Much new equipment has been installed, and new and special apparatus is added from time to time to keep the facilities abreast of recent developments in the field. Special equipment for research and instructional purposes is designed and built in the departmental laboratories. In this way

students are given first hand acquaintance with problems relating to the actual design, construction, and operation of typical equipment used in industry.

OPPORTUNITIES

Opportunities for employment in the chemical and allied industries upon graduation are numerous and varied. Graduates find employment in such fields as: 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 strongly advised to consider graduate training. In fact, the need for persons who have had advanced training in the field beyond the regular four-year program is continually increasing.

CURRICULUM IN CHEMICAL ENGINEERING

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	CHE 205	Chemical Process Principles	4	0
	CHE 311	Introductory Chemical Engineering	0	4
	EC 205	The Economic Process	0	3
	ENG 205	Reading for Discovery	3	0
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	MS 201, 202	Military Science II		
	or			
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			19	19
3	CH 215	Quantitative Analysis	4	0
	CH 531, 532	Physical Chemistry	3	3
	CHE 411	Unit Operations I	0	3
	CHE 415	Chemical Engineering Thermodynamics	4	0
	EE 320	Elements of Electrical Engineering	0	4
	EM 341, 342	Engineering Mechanics A, B	2	2
	SS 301, 302	Contemporary Civilization	3	3
		Electives	3	3
			19	20
4	CH 425, 426	Organic Chemistry	3	3
	CHE 412	Unit Operations II	3	0
	CHE 431, 432	Unit Operations Lab I, II	3	3
	CHE 460	Seminar	1	0
	CHE 525	Process Measurement and Control	3	0
	CHE 527	Chemical Process Engineering	0	3
	MIM 321	Metallurgy	0	3
	SS 491	Contemporary Issues I and		
		Electives in Humanities	3	3
		Electives	3	3
			19	18

— — — — PROFESSIONAL CURRICULUM IN CHEMICAL ENGINEERING

Typical Program

		Credits	
CH 401	Special Topics in Inorganic Chemistry	3	0
CHE 525	Process Measurements and Control	0	3
CHE 546	Chemical Reaction Rates	0	3
CHE 570	Chemical Engineering Projects	2	2
CHE 610, 613	Heat Transfer I, Distillation	3	3
CHE 660	Chemical Engineering Seminar	1	1
PY 407	Introduction to Modern Physics	3	0
	Electives	3	3
		15	15

— — — — — — —GRADUATE STUDY IN CHEMICAL ENGINEERING

Regulations Governing the Professional Program are Shown on Pages 130 and 131.

Graduate work is offered in Chemical Engineering leading to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering. Superior students who can do so are strongly encouraged to spend one or more years in advanced study and research since the demand of the chemical industry for persons with training beyond the baccalaureate is continually increasing.

The Chemical Engineering staff and research facilities provide unusual opportunities for basic and applied work in such important fields as fluid flow, heat transfer, distillation, diffusional operations, plastic technology, etc. Of current interest are special programs in thermal properties of materials at both high and low temperatures, in process measurement and control, and in the use of radioactive tracers in chemical engineering research.

For general regulations, the Graduate School Catalog should be consulted.

— — — — — — — — — — — —CIVIL ENGINEERING

Professor R. E. FADUM, *Head of the Department*
Professors C. R. BRAMER, C. R. MCCULLOUGH, CARROLL L. MANN, JR., M. E. UYANIK
Associate Professor M. V. SMIRNOFF
Assistant Professors R. H. BIGELOW, A. G. FARKAS,* J. W. HORN, C. H. KAHN
Instructors D. N. COTE, C. P. FISHER, JR., G. W. JONES, A. B. MERRITT, JR.
Visiting Lecturer J. F. BONEY

* On leave '58-'59

— — — — — — — — — —DEFINITION OF CIVIL ENGINEERING

Civil Engineering is one of the broadest of the various fields of engineering. It deals with the planning, design and construction of buildings, bridges, dams, harbor works, water works, water power facilities, sewage disposal works and transportation facilities including highways, railways, waterways, airports and pipe lines. The civil engineer's services are in demand by public agencies as well as by private enterprise. The activities of the civil engineer are such that opportunities are available for office-type as well as field-type employment and for employment in small communities as well as in large industrial centers. The breadth in scope of civil engineering and the variety of types of employment open to the civil engineer are such that a student who does not have a strong predilection for some special branch of engineering may be safely advised to study civil engineering.

OBJECTIVES

It is the primary mission of the Civil Engineering Department to offer programs of study designed to provide adequate academic preparation to those contemplating a career in the civil engineering profession. To this end, course work at both the baccalaureate and graduate levels is offered. The undergraduate program is designed to provide a sound general education and at the same time to prepare the student for advanced study in engineering either by the continuation of formal education at the graduate level or by self-study.

FACILITIES

The Department of Civil Engineering is located in Mann Hall. This building provides offices, drafting rooms and classrooms, as well as laboratory facilities for testing structural materials, soils and bituminous products; for hydraulic experiments; for studies in airphoto interpretation and photogrammetry; for analysis of structural models; for chemical and biological tests pertaining to sanitary engineering; and for the investigation of transportation problems. In addition, the facilities of Mann Hall include a comfortable student study room, an auditorium and a departmental library. All of these facilities have been designed to provide for effective teaching and laboratory instruction and to create a scholarly environment.

UNDERGRADUATE CURRICULA

The Department of Civil Engineering offers two four-year undergraduate curricula: the one, leading to the degree of Bachelor of Civil Engineering; the other, to the degree of Bachelor of Civil Engineering, Construction Option.

The Civil Engineering curriculum has been accredited by the Engineers' Council for Professional Development. It is a well-balanced program of study 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.

CURRICULUM IN CIVIL ENGINEERING

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	CE 201, 202	Surveying I, II	3	3
	EM 311	Mechanics I (Statics)	0	3
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
		Humanities	3	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			18	21
3	CE 305, 306	Transportation Engineering I, II	3	3
	CE 321, 322	Materials Testing Laboratory I, II	2	2
	CE 324	Structural Analysis I	0	3
	CE 382	Hydraulics	0	3
	EM 312	Mechanics II (Dynamics)	3	0
	EM 321	Strength of Materials I	3	0
	MA 401	Differential Equations I	3	0
	ME 301	Engineering Thermodynamics I	0	3
	SS 301, 302	Contemporary Civilization	3	3
		Air or Military Science or Electives	3	3
			20	20

4	CE 425	Structural Analysis II	3	0
	CE 427, 428	Structural Design I, II	4	3
	CE 442	Soil Mechanics	3	0
	CE 481	Hydrology and Drainage	2	0
	CE 482	Water and Sewage Works	0	3
	CE 492, 493	Professional Practice I, II	1	1
	EE 320	Elements of Electrical Engineering	0	4
	SS 491	Contemporary Issues I and Elective in Humanities	3	3
		Air or Military Science or Electives	3	3
			19	17

—CONSTRUCTION OPTION

Professor CARROLL L. MANN, JR., *In Charge*

The curriculum in Civil Engineering Construction Option is designed to suit the needs of students who are especially 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 engineering curricula offered at North Carolina State College. It differs from the Civil Engineering curriculum in that special emphasis is given to the construction aspects of civil engineering. To this end the curriculum includes a four-semester sequence of courses in estimates and costs and construction planning and organization. The courses unique to this curriculum are designed to provide academic discipline in the engineering, planning, and management aspects of construction.

—CURRICULUM IN THE CONSTRUCTION OPTION

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	CE 201, 202	Surveying I, II	3	3
	EM 311	Mechanics I (Statics)	0	3
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
		Humanities	3	3
	MS 201, 202 or AS 221, 222	Military Science or Air Science	2	2
	PE 201, 202	Physical Education	1	1
			18	21
3	CE 321, 322	Materials Testing Laboratory I, II	2	2
	CE 324	Structural Analysis I	0	3
	CE 361, 362	Estimates and Costs I, II	3	3
	EC 312	Accounting for Engineers	0	3
	EE 320	Elements of Electrical Engineering	4	0
	EM 312	Mechanics II (Dynamics)	3	0
	EM 343	Strength of Materials I	3	0
	ME 301	Engineering Thermodynamics I	0	3
	SS 301, 302	Contemporary Civilization	3	3
		Air or Military Science or Electives	3	3
			21	20

4	CE 427, 429	Structural Design I, III	4	3
	CE 443	Foundations	0	3
	CE 461, 462	Project Planning and Control I, II	3	3
	CE 464	Legal Aspects of Contracting	0	3
	CE 485	Elements of Hydraulics and Hydrology	3	0
	CE 492	Professional Practice I	1	0
	SS 491	Contemporary Issues I and Elective in Humanities	3	3
		Air or Military Science or Electives	3	3
			17	18

PROFESSIONAL STUDY IN CIVIL ENGINEERING — — — — — — — —

Fifth-year programs of study leading to the professional degree Civil Engineer are offered in the following specialty fields: sanitary engineering, soil mechanics and foundation engineering, structural engineering and transportation engineering. The fifth-year curricula, which are made up of advanced course work, are offered as a continuation of the four-year undergraduate program and are designed for students who are desirous of becoming technically proficient in one of the specialty fields of civil engineering. The following curricula are illustrative of the fifth-year programs of study. It is to be understood, however, that a curriculum for a given student is designed in consultation with his adviser to suit his particular interests.

Regulations Governing the Professional Program are Shown on Pages 130 and 131.

CURRICULUM IN SANITARY ENGINEERING — — — — — — — —

			Credits	
5	CE 571	Theory of Water and Sewage Treatment	3	0
	CE 572	Unit Operations and Processes in Sanitary Engineering	0	3
	CE 573	Analysis of Water and Sewage	3	0
	CE 598	Civil Engineering Projects	2	2
	CE 671	Advanced Water Supply and Sewage	4	0
	CE 672	Advanced Water and Sewage Treatment	0	4
		Electives	3	6
			15	15

CURRICULUM IN SOIL MECHANICS AND FOUNDATION ENGINEERING —

5	CE 507	Airphoto Analysis I	3	0
	CE 524	Analysis and Design of Masonry Structures	0	3
	CE 544	Foundation Engineering	0	3
	CE 548	Soil Testing for Engineering Purposes	0	3
	CE 621	Advanced Structural Analysis I	3	0
	CE 641	Advanced Soil Mechanics	3	0
	CE 643	Hydraulics of Ground Water	0	3
	MA 401	Differential Equations	3	0
		Electives	3	3
			15	15

—CURRICULUM IN STRUCTURAL ENGINEERING

5	CE 521, 522	Advanced Structural Design I, II	3	3
	CE 544	Foundation Engineering	0	3
	CE 621, 622	Advanced Structural Analysis I, II	3	3
	EM 551	Advanced Strength of Materials	3	0
	EM 602	Theoretical and Applied Elasticity	0	3
	MA 401	Differential Equations	3	0
		Electives	3	3
			15	15

—CURRICULUM IN TRANSPORTATION ENGINEERING

5	CE 515	Transportation Analysis	3	0
	CE 516	Transportation Engineering Design	3	0
	CE 601	Transportation Planning	0	3
	CE 602	Advanced Transportation Engineering Design	0	3
	CE 603	Airport Planning and Design	0	3
	CE 604	Urban Planning and Mass Transportation	0	3
		Electives	9	3
			15	15

—GRADUATE STUDY IN CIVIL ENGINEERING

The graduate degrees offered by the Civil Engineering Department are the Master of Science in Civil Engineering and the Doctor of Philosophy. At North Carolina State College, facilities for research and graduate instruction are available in the areas of sanitary engineering, soil mechanics and foundation engineering, structural engineering and transportation engineering. For additional information concerning graduate study opportunities in Civil Engineering, the current issue of the Graduate School Catalogue of North Carolina State College should be consulted.

—ELECTRICAL ENGINEERING

Professor G. B. HOADLEY, *Head of the Department*
Professors W. J. BARCLAY, J. H. LAMPE, W. D. STEVENSON, JR.
Associate Professors K. B. GLENN, E. G. MANNING, E. W. WINKLER
Assistant Professors A. J. GOETZE *, R. J. PEARSALL, E. H. TOMPKINS, JR.
Instructors H. MOTT, P. I. PADUNCHEWIT, H. D. RANDOLPH, H. W. THOMPSON, F. L. THURSTONE, R. L. THURSTONE

* On leave of absence

—OBJECTIVES

The purpose of the undergraduate curriculum is to train young men for active work in a wide and diversified field. The electrical industry demands, above all else, a thorough preparation in the sciences underlying all branches of engineering, a broad foundation in fundamental electrical theory and a clear understanding of the characteristics of electrical machinery and systems. These factors are essential for success, whether it be in the design and manufacture of electrical equipment, in power production and utilization, or in the fields of communication and electronics, since in all of these branches of the industry technical advances are being made with increasing rapidity.

–CURRICULUM

With this object in view, the curriculum in Electrical Engineering includes comprehensive training in mathematics and physics—the fundamental sciences—and adequate training in allied branches of engineering. All

courses are accompanied by coordinated work in the laboratory and intensive drill in the application of theory by means of carefully planned problems. In the senior year, the student is offered a choice of Power, Communications, or Controls.

The curriculum includes a thorough drill in the preparation and delivery of technical reports.

Each student is required to spend at least six weeks in satisfactory industrial employment before receiving his degree.

FACILITIES

The Department is housed in Daniels Hall. It maintains the following laboratories: Dynamo, Communications and Electronics, Industrial Electronics and Control, Sophomore, Standards, and Photometry. In addition, there are an instrument room, a shop and a number of research rooms.

DEPARTMENTAL STUDY ACTIVITIES

Close coordination with the work of the professional electrical engineering societies is maintained through the AIEE-IRE Joint Student Branch which meets twice a month. Faculty advisers assist the students in bringing to these meetings practicing engineers. The Joint Student Branch also sponsors departmental activities such as picnics for new students and departmental participation in the Engineering Fair.

An active chapter of Eta Kappa Nu, the national honorary Electrical Engineering fraternity, undertakes numerous important projects in addition to holding two initiation banquets yearly.

CURRICULUM IN ELECTRICAL ENGINEERING

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EE 201, 202	Elementary Circuits and Fields	4	4
	ENG 205	Reading for Discovery; and		
	EC 205	The Economic Process	3	3
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	MS 201, 202*	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education*	1	1
			19	19
3	EE 301, 302	Intermediate Circuits and Fields	4	3
	EE 305	Electrical Machinery	4	0
	EE 414	Electronics	0	4
	EM 311	Mechanics I (Statics)	3	0
	EM 312	Mechanics II (Dynamics)	0	3
	MA 401	Differential Equations	0	3
	PY 407	Introduction to Modern Physics	3	0
	SS 301, 302	Contemporary Civilization	3	3
		Electives**	3	3
			20	19

4

		Credits	
EE 411	Electrical Engineering Senior Seminar	1	0
EE 501, 502	Advanced Circuits and Fields	3	3
EM 321	Strength of Materials I	0	3
MA 405	Introduction to Determinants and Matrices, or		
MA 501	Numerical Analysis I, or		
MA 511	Advanced Calculus I, or		
MA 532	Differential Equations II, or		
MA 541	Vector Analysis	3	0
ME 301, 303	Engineering Thermodynamics I, III	3	3
SS 491	Contemporary Civilization	3	0
	Departmental Electives	3	3
	Electives in the Humanities or Social Sciences	0	3
	Electives**	3	3
		19	18

* Students excused from Miltary or Air Science and/or Physical Education will schedule equivalent credits in courses outside their department.

** The Junior and Senior Electives may be taken in advanced Military Science. If not, they are free electives, subject to the approval of the student's adviser and the Department Head.

— — — — — —PROFESSIONAL STUDY IN ELECTRICAL ENGINEERING

A fifth, or professional, year of study is offered in Electrical Engineering as a continuation of the four-year undergraduate program. This fifth year of study offers specialized and advanced course work leading to the degree of Electrical Engineer.

Each student taking this fifth year work has his program of courses planned to meet his individual needs. The following curricula are illustrative only, and are printed merely to show the sort of program a professional student might follow.

Regulations Governing the Professional Study are Shown on Pages 130 and 131.

CURRICULUM

TYPICAL PROGRAMS

— — — — — — — — — — — — — — ELECTRIC POWER

5

		Credits	
EE 605	Electrical Engineering Seminar	1	0
EE 635	Dielectric Theory	3	0
EE 636	High Voltage Engineering	0	3
EE 637	Circuit Analysis of Power Systems	3	0
EE 638	Power System Stability	0	3
EM 531	Hydraulic Machinery	2	0
EM 554	Vibration Problems	0	3
MA 511, 512	Advanced Calculus I, II	3	3
ME 401	Power Plants	3	0
ME 502	Heat Transfer	0	3
		15	15

— — — — — — — — — — — — — — COMMUNICATIONS

5

EE 605, 606	Electrical Engineering Seminar	1	1
EE 611, 612	Communications Network	4	4
EE 615	Electromagnetic Waves	4	0
EE 616	Advanced Radio Engineering	0	4
MA 511, 512	Advanced Calculus I, II	3	3
PY 407	Introduction to Modern Physics	3	0
PY 544	Vibration and Wave Motion	0	3
		15	15

GRADUATE STUDY IN ELECTRICAL ENGINEERING

The graduate degrees offered by the Department of Electrical Engineering are the Master of Science in Electrical Engineering and the Doctor of Philosophy in Electrical Engineering.

At North Carolina State College, the graduate offering in electronics and communications includes courses in Electric Communications, Communication Networks, Advanced Radio Engineering, Radiation and Antennas and Vacuum Tube Design. These courses are supplemented by experimental work carried on in various special departmental laboratories, such as the high-vacuum laboratory and the microwave laboratory. These special laboratories, together with a number of small laboratories in which graduate students carry on individual research problems, are in the newly constructed Daniels Hall addition.

Graduate students specializing in electric power have the opportunity of taking courses in Electric Transmission, Power Network Calculations, Theory and Design of Electric Machines, Industrial Electronics and Control, High Voltage Engineering and Power Systems. In this case also there are special laboratories such as the high-voltage laboratory and the servomechanisms laboratory, in which laboratory instruction related to these courses is given, and there are individual research rooms for thesis work.

For further information concerning graduate study in Electrical Engineering, the current Graduate School Catalog of North Carolina State College should be consulted.

ENGINEERING MECHANICS

Professor G. WALLACE SMITH, *Head of Department*
Professor ADOLPHUS MITCHELL
Assistant Professors MAURICE H. CLAYTON, JOSEPH E. HARDEE, GEORGE W. MIDDLETON
Instructor HALBERT F. BRINSON

UNDERGRADUATE STUDY

The Department of Engineering Mechanics teaches and administers the courses in theoretical and applied mechanics, strength of materials and fluid mechanics. These courses are fundamental to the professional and design courses of the several Engineering curricula. The student is expected to acquire a basic knowledge of the physical properties of materials and the laws that govern their use in engineering design.

GRADUATE STUDY

A student who is interested in investigation and research, and who has the proper prerequisite, may take a course of study offered by this department which leads to the degree of Master of Science in Engineering Mechanics. For general regulations of the Graduate School, the Graduate School Catalog should be consulted.

THE DEPARTMENT OF ENGINEERING RESEARCH

N. W. CONNER, *Director*
Professor of Mechanical Engineering J. F. LEE
Research Professor of Ceramic Engineering W. C. BELL
Research Professor of Mechanical Engineering P. H. MCDONALD, JR.
Research Associate Professor of Metallurgy H. H. STADELMAIER
Research Associates KING R. BROSE, L. J. HUETTER, LAWRENCE B. MCGEE, FRANCES M. RICHARDSON
Research Assistants S. W. DERBYSHIRE, ANNA C. FRAKER, W. M. KENAN, ARTHUR E. LUCIER, R. B. MOFFITT, JAMES T. TANNER, JR., W. D. WILKINSON

OBJECTIVES

Research and teaching are the two responsibilities of the true university. The School of Engineering has a clear appreciation of the obligation of education to further man's understanding of the world in which he lives and of the contribution of research to effective teaching. Within the School, research programs are conducted in many fields of engineering; these activities are given strong encouragement and support through the Department of Engineering Research.

As a unit of North Carolina's Land-Grant College, the School of Engineering is obligated to serve the industrial life of the state. Functioning in this capacity, it offers a broad program of service and experimental aid through the Department of Engineering Research. Many industries in the state have brought problems to the School; association with the industrialists of the state is being sought and strengthened constantly. This service is further strengthened through close cooperation with the North Carolina Department of Conservation and Development. Particular encouragement and assistance are granted those investigations that give promise of new industry to North Carolina.

FACILITIES

The Department of Engineering Research, established originally in 1923 as the Engineering Experiment Station, maintains laboratories and a full-time staff devoted exclusively to experimental work. Its operations are carried out in close cooperation with the administration and faculties of the teaching departments. The abilities of the various departments of engineering are combined through the Department so that the complete research capacity of the School of Engineering is available for experimental work in any field. The Department also acts as the administrator for the School in negotiations involving research programs done for private industry and for governmental agencies.

The Minerals Research Laboratory in Asheville is engaged in the expansion of North Carolina mineral production through facilities for the development of improved processes of mineral concentration, or examination and appraisal, and chemical analysis.

The Industrial Experimental Program was created by the 1955 General Assembly acting upon a request from the School of Engineering. Its objective is to provide technical assistance to the State's small industry and to promote utilization of its natural resources.

RESEARCH PROGRAMS

Today the research capacity of the nation is being called upon as a resource for national security. Research facilities of colleges and universities are prominent in this defense capacity, and the School of Engineering at North Carolina State College is now strong in its ability to serve among the leading engineering schools of the country. Several research programs sponsored by the services have been in progress for several years; the School's capacity for expanded service is large.

Research currently in progress includes work being done for the Air Material Command of the U. S. Air Force, the Office of Ordnance Research, the Bureau of Ships, the Wright Air Development Center, Redstone Arsenal, and the Texas Company. Work is included in the fields of structural clay products, radiant heating, stress analysis, rotational speed deviation measurements, tannin extraction, recovery from fish waste, erosion of plastics, fuel oils, precipitation hardening and diffiusion in alloys and electronics.

Upon their conclusions, results of the engineering investigations are published as bulletins so that the information obtained may be made avail-

able to the public and be contributed to the total field of technical knowledge. A complete list of the bulletins published to date or any other information pertaining to the operation or availability of the facilities of the Department will be furnished upon request.

RESEARCH FELLOWSHIPS

To assure wider benefits for both graduate and undergraduate students from the engineering research activities, the Department offers several Research Fellowships and employs some of the more promising and deserving students as assistants in the laboratory on a part-time basis.

INDUSTRIAL ENGINEERING

Professor CLIFTON A. ANDERSON, *Head of the Department*
Professor R. G. CARSON, JR., E. S. JOHNSON
Visiting Professors R. WILLARD, J. S. LITTLE
Associate Professor R. W. LLEWELLYN
Assistant Professors R. ALVAREZ, R. L. COPE

OBJECTIVES

Industrial Engineering is a relatively new branch of the engineering profession. It has seen its greatest growth commencing with the industrial expansion required in the war years. As a college curriculum, it is the result of a demand by industry for graduates who are trained in the fundamentals of engineering and who have acquired a knowledge of the principles involved in planning, operating and controlling the operations of an industrial enterprise.

CURRICULUM

It is the industrial engineer's job to transform plans, specifications and blueprints into plant, equipment and personnel to create the product. He is concerned also with controls and plans for the profitable and continued operation of an existing plant.

The Industrial Engineering program at North Carolina State College has been planned with this viewpoint in mind. After the first year, which is common with all other branches of engineering, the curriculum includes subject matter in Industrial Organization and Management, Motion and Time Study, Plant Layout, Quality Control, Job Evaluation, Accounting, Personnel and Labor Relations and Production Control together with other specialized courses which help develop a background and technique for understanding our modern industrial system.

The Industrial Engineering curriculum has been inspected and accredited by the Engineers' Council for Professional Development.

STUDENT ACTIVITIES

Student organizations within the department include a chapter of the American Institute of Industrial Engineers. This student function has demonstrated its calibre by earning first place in the Annual Student Award for 1956-57 in competition with AIIE chapters at all other institutions. Departmental and student activities of a professional and a social character are sponsored by the organization.

An active chapter of Alpha Pi Mu, the Industrial Engineering Honor Society, gives recognition to the outstanding students in the Junior and Senior classes. The membership annually undertakes projects of value to I.E. Students and the department.

— — — — — — — — CURRICULUM IN INDUSTRIAL ENGINEERING

For the Freshman Year, Refer to Page 97

			Credits	
2	EC 205	The Economic Process	3	0
	ENG 205	Reading For Discovery	0	3
	IE 201, 202	Industrial Engineering I, II	3	3
	IE 217	Machine Tools	1	0
	IE 218	Metal Forming	1	0
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	PSY 200	Introduction to Psychology	0	3
	MS 201, 202 or AS 221, 222	Military Science or Air Science	2	2
	PE 201, 202	Physical Education	1	1
			20	21
3	EC 312	Accounting for Engineers	3	0
	EM 341	Mechanics A (Statics)	2	0
	EM 342	Mechanics B (Dynamics)	0	2
	IE 303, 304	Industrial Engineering III, IV	4	4
	MA 401	Differential Equations I	3	0
	MA 405	Introduction to Detrimants & Matrices	0	3
	SS 301, 302	Contemporary Civilization	3	3
	ST 361, 362	Statistics for Engineers	3	3
		Elective	3	3
			21	18
4	EE 331, 332	Principles of Electrical Engineering	4	4
	EM 343	Strength of Materials A	2	0
	IE 401, 402	Industrial Engineering Analysis	3	3
	IE 451	Seminar	1	0
	ME 301	Engineering Thermodynamics I	3	0
	SS 491	Contemporary Issues I	3	0
		Humanities Elective	0	3
		Technical Elective	0	3
		Elective	3	3
			19	16

Proficiency in written expression to be demonstrated at the beginning of the Junior year. Students who fail this text are to be required to take additional work in the English Department; and to repeat the test. Such work will be in addition to the normal courses required for graduation.

— — — — — — PROFESSIONAL STUDY IN INDUSTRIAL ENGINEERING

A fifth, or professional, year of study is offered in Industrial Engineering as a continuation of the four-year undergraduate program. This fifth year of study offers specialized and advanced course work leading to the degree of Industrial Engineer.

Regulations covering this Degree are shown on pages 130 and 131.

TYPICAL PROGRAM

		Credits	
IE 425	Sales and Distribution Methods	0	2
IE 515	Process Engineering	3	0
IE 517	Automatic Processes	3	0
IE 543	Standard Data	3	0
IE 551	Standard Costs for Manufacturing	0	3
IE 581	Project Work	2	2
IE 635	Planning for Production	0	3
IE 671	Seminar	1	1
		12	11

GRADUATE STUDY IN INDUSTRIAL ENGINEERING

For general regulations, The Graduate School Catalog should be consulted. Graduate work is offered in Industrial Engineering leading to the degree of Master of Science in Industrial Engineering.

FURNITURE MANUFACTURING AND MANAGEMENT

Professor E. SIGURD JOHNSON, *In Charge*

OBJECTIVES

Any curriculum in the School of Engineering has as an aim the preparation of men capable of handling the technical problems arising in the jobs which they undertake. Where industry is already equipped with qualified engineers, the new employee with a basic engineering education can be given on-the-job training in analyzing and solving the special problems peculiar to the particular plant or industry.

In the case of the furniture industry, practically no experienced engineers exist. To be of service the College must emphasize to a greater extent the application of engineering principles to the problems of the furniture industry. This can be done effectively only if the instructional staff is aware of the problems of the industry from direct contact and not merely from academic discussion and the available literature. Consequently the program has been worked out in conjunction with representatives of the manufacturers. Their viewpoint is based on a survey made among the entire membership of the Southern Furniture Manufacturers' Association. Results of the survey indicate an overwhelming interest in college training to prepare men for work in this industry.

CURRICULUM

It is the purpose of the curriculum offering the degree of Bachelor of Science in Furniture Manufacturing to prepare graduates for technical and, eventually, executive positions in the furniture industry. The curriculum will emphasize the application of engineering to furniture manufacturing. Related subjects covering management, labor relations, accounting, marketing and sales will stress the technical as well as the human side of modern production methods and techniques.

STUDENT ACTIVITIES

The Industrial Engineering Department sponsors the Furniture Club, which is operated by the students. All students in the curriculum are eligible for membership in the organization. The club brings in speakers from industry and holds social gatherings for the students.

— — — FURNITURE MANUFACTURING AND MANAGEMENT CURRICULUM

1 See page 97

			Credits	
2	ENG 205	Reading For Discovery	0	3
	ENG 211	Business Communications	3	0
	ENG 231	Basic Speaking Skills	0	3
	FOR 201	Wood Structure and Properties	3	0
	FOR 303	Wood Moisture Relations	0	3
	HI 205	The Modern Western World	3	0
	IE 224	Wood Working Equipment	0	3
	PY 211, 212	General Physics	4	4
	PSY 200	Introduction to Psychology	3	0
	TX 271	Upholstery Fabrics	2	0
	MS 201, 202	Military Science or		
	AS 221, 222	Air Science	2	2
	PE 201, 202	Physical Education	1	1
			21	19
3	EC 312	Accounting for Engineers	3	0
	FOR 433	Gluing and Plywood	3	0
	FOR 443	Wood Finishing	0	3
	IE 201, 202	Industrial Engineering I & II	3	3
	IE 322	Furniture Design and Construction	2	0
	IE 326	Furniture Manufacture and Processing	0	4
	SS 301, 302	Contemporary Civilization	3	3
		Tech. Elective	2	3
		Elective	3	3
			19	19
4	EC 432	Industrial Relations	2	0
	FOR 444	Introduction to Quality Control	0	3
	IE 303, 304	Industrial Engineering III, IV	4	4
	IE 341	Furniture Plant Layout and Design	3	0
	IE 451, 452	Seminar	1	1
	SS 491	Contemporary Issues I and		
		Elective in Humanities	3	3
	ST 361	Introduction to Statistics for Engineers	3	0
		Tech. Elective	0	3
		Elective	3	3
			19	17

— — — — — — THE DEPARTMENT OF MATHEMATICS

Professor JOHN W. CELL, *Head of the Department*
Professors R. C. BULLOCK, J. M. CLARKSON, * W. J. HARRINGTON, JACK LEVINE, C. G. MUMFORD, H. M. NAHIKIAN, H. V. PARK, J. D. PAULSON, H. P. WILLIAMS, L. S. WINTON
Associate Professors A. R. NOLSTAD, G. C. WATSON
Assistant Professors R. C. BOLES, V. R. BRANTLEY, G. C. CALDWELL, E. J. CANADAY, H. C. COOKE, ANNA MAE HARRIS, C. F. LEWIS, C. H. LITTLE, JR., R. A. MACKERRACHER, A. MALTBIE, D. M. PETERSON, H. A. PETREA, P. SHAHDAN, H. E. SPEECE, E. H. TOMPKINS, JR., J. B. WILSON
Instructors C. N. ANDERSON, J. W. BISHIR, F. G. DOLLY, MARTHA J. GARREN, RUTH B. HONEYCUTT, CARLOTTA P. PATTON, J. L. SOX, WILDA WEBSTER
* On leave

ENGINEERING

OBJECTIVES

There is great need both in industry and in the field of teaching for people trained in applied mathematics. The increasing use of both digital and analog computers and the shift to automation in industry have given rise to requirements for mathematics analysts. The Department of Mathematics offers opportunities in the elementary and advanced courses for the student to learn important concepts in mathematics and to apply these to situations in engineering and the sciences.

CURRICULUM

The curriculum for the Bachelor of Science in Engineering Mathematics has been set up to provide the student with a sound foundation in mathematics, and at the same time to give enough flexibility to permit the student to carry out a rather thorough study in some field of Engineering. The number of required courses has thus been held to a minimum in order that the individual needs of students may be met more readily. It will be the duty of the student's individual adviser to direct the student in the choice of a sound program of electives. The curriculum is designed especially to meet the needs of students who wish to go into positions in industry requiring a good mathematical background and who therefore will require mathematics *plus* a knowledge in some branch of application.

The program for the Master's Degree in Applied Mathematics presupposes either an undergraduate degree in engineering or a degree in applied mathematics, or a Bachelor of Arts degree with proper emphasis in physics or equivalent background material. The student's program will be planned by his graduate advisory committee. A minor is required in one or two fields of engineering or in statistics.

CURRICULUM IN ENGINEERING MATHEMATICS

			Credits	
1	See page 97			
2	EC 205	The Economic Process and		
	ENG 205	Reading for Discovery	3	3
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	MS 201, 202	Military Science II or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
		* Technical Electives	3	3
			18	18
	MA 401	Differential Equations and		
		*** Mathematics Elective	3	3
3	SS 301, 302	Contemporary Civilization	3	3
	ST 361	Introduction to Statistics for Engineers	0	3
		** Engineering Sequence	3	3
		* Technical Electives	8	4
		Elective	3	3
			20	19

All elective courses are to be chosen subject to approval of the student's adviser and of the department head.

* Technical electives may be chosen from any of the below mentioned courses or others in similar areas on consultation with the adviser. Six hours of these electives are normally chosen from ML 101, 102; ML 103, 104; ML 110, 212; ML 112, 113; etc.

** The Engineering sequence is, as a minimum, a four course sequence normally consisting of EM 311, 312, 321, 430, or EM 341, 342, 321, 430 plus ME 301 or four courses chosen from PY 401, 402, 403, 404, 407. Other courses in these areas may be added as technical electives. Other sequences may be chosen from EE 201, 202, 301, 302, 414, 501, 502, 511, 512. CHE 301, 302, 411, 412, 415 ME 301, 302, 351, 352, 453 or equivalent.

*** The Mathematics electives may be chosen from MA 402, 403, 405, 501, 502, 514, 522, 532, 533, 541.

4	MA 511, 512	Advanced Calculus I, II	3	3
	MA 535	An Introduction to Computers and		
		*** Mathematics Elective	3	3
	SS 491	Contemporary Issues I and		
		Humanities Elective	3	3
		** Engineering Sequence	3	3
		Elective	3	3
	EC 555	Introduction to Linear Programming		
		or # Statistics	3	0
		* Technical Electives	0	5
			18	20

Statistics electives may be chosen from ST 362, 515, 516, 522.

CURRICULUM FOR MASTER OF SCIENCE IN APPLIED MATHEMATICS

The Department of Mathematics feels that a student entering the Graduate School to work toward the degree of Master of Science in Applied Mathematics should be well grounded in mathematics through at least one term of Advanced Calculus (or its equivalent). In addition, he should have a strong background in mechanics and physics, or in some branch of Engineering.

Minimum course requirements for the degree of Master of Science in Applied Mathematics are thirty hours of which six to nine hours must be selected from a minor field which is usually some branch of Engineering, Physics, or Statistics. In addition to the above requirements, the student must write a thesis and show a satisfactory reading knowledge of a foreign language.

For more detailed information see the Graduate Catalog.

MECHANICAL ENGINEERING

Professor K. P. HANSON, *Head of the Department*
Professors J. S. DOOLITTLE, V. M. FAIRES, R. B. KNIGHT, J. F. LEE, P. H. MCDONALD, JR., R. M. PINKERTON, J. WOODBURN
Associate Professors W. E. ADAMS, W. S. BRIDGES, T. C. BROWN, E. L. HARRISBERGER, J. K. WHITFIELD
Assistant Professors J. J. CLEARY, A. W. FUTRELL, JR., B. F. GOLDHAMMER, T. B. LEDBETTER, P. B. LEONARD, T. J. MARTIN, JR.
Instructors W. E. BLIZARD, C. B. BOMAR, V. E. HOLT, H. K. MCMILLAN, R. A. MULLEN, T. L. NASH, E. H. STINSON, J. B. WALKER, B. D. WEBB, C. A. WINGATE, JR.

OBJECTIVES

The Mechanical Engineering Department offers a four-year bachelor's program in Mechanical Engineering and in Aeronautical Engineering as an option in the Mechanical field. The curricula in both Mechanical Engineering and the Aeronautical option are accredited by the Engineers' Council for Professional Development.

The mechanical engineer is primarily a designer and builder of machines and other equipment for use in manufacturing processes, transportation and the generation of power. He is responsible for the conservation and economical use of the power-producing resources of the world through the application of the proper equipment in each field of production. He is called upon to take charge of the management of the manufacturing and power industries. For the mechanical engineer to be well grounded in his profession, he must be thoroughly familiar with both the science and the art of engineering.

CURRICULUM

The curriculum in Mechanical Engineering begins with a thorough training in mathematics, physics and chemistry, as a foundation for the technical work which is later developed along several parallel lines. The student is taught how these fundamental sciences are applied to the physical properties of the materials of construction and to the transformation of heat energy into work and power. This is accomplished by means of courses in theory and through instruction in the mechanical laboratories.

The curriculum in Aeronautical Engineering (option under Mechanical Engineering) embodies the same basic studies as the Mechanical Engineering program, specializing in Aeronautical sciences in the junior and senior years. Graduates of this curriculum are prepared to take their places in the fields of design, production and research in the Aeronautical industries.

The primary objective of the Aeronautical Option is to provide general training in subjects fundamental to Aeronautical Engineering. In general, the professional subjects are directed toward aerodynamics, structures and airplane design with special emphasis on the fundamental treatment of aeronautical science; to familiarize the student with the principles of flight and with the general criteria of design and construction as applied to the airplane. Classroom work is supported by experimental activities in the aeronautical laboratory which offers facilities in wind tunnel, structural and instrument studies. The first three years of study are, for the most part, devoted to fundamental subjects, the strictly professional work being deferred until the fourth year.

Through the training offered in this department, it is hoped that the young graduate, after gaining some experience in industry, will be qualified to accept the responsibilities which will be imposed upon him in Mechanical and Aeronautical industries.

CURRICULUM IN MECHANICAL ENGINEERING

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EM 311	Mechanics I (Statics)	0	3
	ENG 205	Reading for Discovery	3	0
	HI 205	The Modern Western World	0	3
	IE 217, 218	Machine Tools; Metal Forming	1	1
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics I, II	5	5
	MS 201, 202 AS 221, 222	Military Science II or Air Science II	2	2
	PE 201, 202	Physical Education	1	1
		Elective	3	0
			19	19
3	EM 312	Mechanics II (Dynamics)	3	0
	EM 321	Strength of Materials I	0	3
	EM 430	Fluid Mechanics	0	2
	MA 401	Differential Equations I	3	0
	ME 301, 302	Engineering Thermodynamics I, II	3	3
	ME 305, 306	Mechanical Engineering Laboratory I, II	1	1
	ME 311	Kinematics	3	0
	ME 312	Dynamic Analysis	0	3
	SS 301, 302	Contemporary Civilization	3	3
		Electives, Military or Air Science	3	3
			19	18

SUMMER REQUIREMENT: Six weeks' industrial employment

4	EE 331, 332	Principles of Electrical Engineering	4	4
	ME 401	Power Plants	3	0
	ME 405, 406	Mechanical Engineering Laboratory III, IV	1	1
	ME 411, 412	Machine Design I, II	3	3
	ME 441	Technical Seminar	1	0
	ME 502	Heat Transfer	0	3
	MIM 421, 422	Metallurgy I, II	2	2
	MIM 423	Metallurgy Laboratory	0	1
	SS 491	Contemporary Issues I; and		
		Elective in Humanities	3	3
		Electives, Military or Air Science	3	3
			20	20

CURRICULUM IN AERONAUTICAL OPTION

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EM 311	Mechanics I (Statics)	0	3
	ENG 205	Reading for Discovery	3	0
	HI 205	The Modern Western World	0	3
	IE 217, 218	Machine Tools; Metal Forming	1	1
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics I, II	5	5
	MS 201, 202	Military Science II or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
		Elective	3	0
			19	19
3	EM 312	Mechanics II (Dynamics)	3	0
	EM 321	Strength of Materials I	0	3
	MA 401	Differential Equations	3	0
	ME 301, 302	Engineering Thermodynamics I, II	3	3
	ME 305, 306	Mechanical Engineering Laboratory I, II	1	1
	ME 311	Kinematics	0	3
	ME 351	Elements of Aeronautical Engineering	3	0
	ME 352	Aerodynamics	0	3
	SS 301, 302	Contemporary Civilization	3	3
		Electives, Military or Air Science	3	3
			19	19

SUMMER REQUIREMENT: Six weeks' industrial employment

4	EE 320	Elements of Electrical Engineering	4	0
	ME 410	Jet Propulsion	0	3
	ME 441	Technical Seminar	1	0
	ME 459	Aircraft Structures	3	0
	ME 455, 456	Aeronautical Laboratory I, II	1	1
	ME 461, 462	Airplane Design I, II	3	3
	ME 536	Aircraft Engines	0	3
	MIM 421, 422	Metallurgy I, II	2	2
	MIM 423	Metallurgy Laboratory	0	1
	SS 491	Contemporary Issues I; and		
		Elective in Humanities	3	3
		Electives, Military or Air Science	3	3
			20	19

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HEATING AND AIR CONDITIONING

Professor R. B. KNIGHT, *In Charge*

OBJECTIVES

The objective of the program in Heating and Air Conditioning offered by the Mechanical Engineering Department is to train young men in this specialized field and prepare them to take positions in industry in the design, construction and operation of heating, ventilating and air conditioning systems as well as in the management of such industries and as sales representatives of companies manufacturing equipment for the trade.

CURRICULUM

The curriculum has the first year in common with the regular engineering program and starts specialization in the second year. Sufficient basic science courses are required in the first years to establish a firm foundation for the more technical courses in the later years. Training is accomplished by lecture, recitation and demonstration work with a liberal inclusion of laboratory work illustrating the theory and drawing attention to the practical aspects of the subject. Provision is made for the more liberal aspects of college education through the humanities courses. Electives in the junior and senior years for those who do not choose advanced Military Science allow further liberal or technical education in any group of courses which will meet with the objectives of the individual.

DEGREES

The four-year program in Heating and Air Conditioning leads to the degree of Bachelor of Science in Heating and Air Conditioning.

HEATING AND AIR CONDITIONING CURRICULUM

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EC 205	The Economic Process; and		
	ENG 205	Reading for Discovery	3	3
	EC 312	Accounting for Engineers	0	3
	ENG 211	Business Communications	3	0
	EM 341	Mechanics "A" (Statics)	0	2
	IA 215	Sheet Metal	1	0
	IE 269	Welding and Pipe Shopwork	0	1
	MA 201	Calculus I	4	0
	ME 271, 272	Air Conditioning Drawing I, II	2	2
	PY 211, 212	General Physics	4	4
	MS 201, 202	Military Science II or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			20	18
3	CE 351	Details of Building Construction	2	0
	EE 341, 342	Industrial Electricity	4	4
	EM 342	Mechanics 'B" (Dynamics)	2	0
	EM 343	Strength of Materials A	2	0
	EM 430	Fluid Mechanics	0	2
	ME 371, 372	Elementary Heat Power I, II	3	3
	ME 375, 376	Air Conditioning Laboratory I, II	1	1
	ME 381	Air Conditioning I	0	3
	SS 301, 302	Contemporary Civilization	3	3
		Electives, Military or Air Science	3	3
			20	19

SUMMER REQUIREMENT: Six weeks' industrial employment.

4	EC 407	Business Law I	0	3
	EC 425	Industrial Management	3	0
	IE 425	Sales and Distribution Methods	0	2
	ME 379	Mechanical Equipment of Building	0	3
	ME 382	Air Conditioning II	3	0
	ME 473	Refrigeration	3	0
	ME 475, 476	Air Conditioning Laboratory III, IV	1	1
	ME 481, 482	Air Conditioning Design I, II	3	3
	SS 491	Contemporary Issues I; and Elective in Humanities	3	3
		Electives, Military or Air Science	3	3
			19	18

— — — — — — PROFESSIONAL STUDY IN MECHANICAL ENGINEERING

A fifth, or professional year of study is offered in Mechanical Engineering as a continuation of the four-year undergraduate program. This fifth year of study offers specialized and advanced work leading to the degree of Mechanical Engineer.
Regulations Covering this Degree are Shown on Pages 130 and 131.

CURRICULUM

Typical Programs

			Credits	
		HEAT-POWER		
5	ME 501	Steam and Gas Turbines	3	0
	ME 502	Heat Transfer	0	3
	ME 545, 546	Project Work in Mechanical Engineering I, II	2	2
	ME 601	Advanced Engineering Thermodynamics I	3	0
	ME 603	Advanced Power Plants	3	0
	ME 604	Nuclear Power Plants	0	3
	ME 641, 642	Mechanical Engineering Seminar I, II	1	1
		Approved Electives	3	6
			15	15
		DESIGN		
5	EM 554	Vibration Problems	0	3
	MA 401	Differential Equations	3	0
	ME 515	Experimental Stress Analysis	3	0
	ME 517	Lubrication	0	3
	MIM 521, 522	Advanced Physical Metallurgy I, II	3	3
	ME 545, 546	Project Work in Mechanical Engineering I, II	2	2
	ME 611, 612	Advanced Machine Design I, II	3	3
	ME 641, 642	Mechanical Engineering Seminar I, II	1	1
			15	15

		AERONAUTICAL		
5	ME 453	Applied Aerodynamics	3	0
	ME 502	Heat Transfer	3	3
	ME 552	Aircraft Applied Loads	3	0
	ME 554	Advanced Aerodynamic Theory	0	3
	ME 545, 546	Project Work in Mechanical Engineering I, II	2	2
	ME 562	Advanced Aircraft Structures	0	3
	ME 641, 642	Mechanical Engineering Seminar I, II	1	1
		Approved Electives	3	3
			15	15

GRADUATE STUDY IN MECHANICAL ENGINEERING

Graduate work leading to the degree of Master of Science in Mechanical Engineering is offered in three specific fields: Heat-Power, Design and Aeronautics. Graduate staff members in these fields are men of national reputation for their achievement and competency. Active research programs in the fundamentals and application of Mechanical Engineering provide excellent opportunities for graduate students to gain competency in their selected field of study.

For general regulations, the Graduate School Catalog should be consulted.

MINERAL INDUSTRIES

Professor W. W. AUSTIN, *Head of the Department*
Professors W. C. BELL, I. FERENCZI, W. W. KRIEGEL, J. M. PARKER, III
Associate Professors W. C. HACKLER, L. J. HUETTER, E. L. MILLER, JR., H. H. STADELMAIER
Special Lecturer A. A. FAHMY
Instructors G. O. HARRELL, H. PALMOUR, III

OBJECTIVES

The primary objectives of the Department of Mineral Industries are the training and professional development of qualified technical and administrative leaders for those industries concerned with the location and utilization of mineral resources. Included within this scope of operation are the fields of Geological, Ceramic and Metallurgical Engineering.

CURRICULA

Complete four-year undergraduate curricula in Geological, Ceramic and Metallurgical Engineering are available in the Department. Fifth year professional programs are also available for advanced work and specialization in each of these fields, and graduate programs leading to the Master's and Doctor's degrees in Ceramic Engineering, and to the Master's degree in Geological Engineering and Metallurgical Engineering are offered.

FACILITIES

The facilities of the Department of Mineral Industries are housed in Page Hall and the Ceramic Building. Located in Page Hall are departmental offices, drawing rooms, classrooms and extensive laboratory facilities for instructional work and research in the three areas of study covered by the department. Typical of the numerous well equipped laboratories in the building are those established for instruction in the following areas of study; ceramic operations and processes, dielectric measurements, ceramic

microscopy, physical geology, mineralogy, mineral dressing, petrology, physical metallurgy and metallography. Other laboratory facilites particularly kilns and furnaces are housed in the Ceramic Building next door. Important additional facilities for instruction and research are located in the Engineering Research Department's Ceramic and Metallurgical Research Laboratories. Here equipment and instrumentation are available for advanced work in high temperature technology, X-Ray diffraction, radiography, electron microscopy and photomicrography.

DEPARTMENTAL STUDENT ACTIVITIES

The Student Branches of the American Ceramic Society, American Society for Metals, and the American Institute of Mining and Metallurgical Engineers (Rockhound Society) through their monthly meetings provide an effective medium for the professional growth of the student engineers. Programs include presentation of student papers, guest speakers and social contact between student and staff. Participation acquaints the student with parliamentary and organizational procedures which are of great importance to professional, industrial and civic life. Students are encouraged to attend Southeastern Section and National meetings of their respective societies. Keramos, the oldest professional engineering fraternity, has an active chapter on the campus. This fraternity is dedicated to the promotion of scholarship, mental achievement and general service to ceramic engineering students. It carries on various projects, one of which is the "Big Brother Project" to help freshmen in their orientation in college life.

CERAMIC ENGINEERING

The undergraduate curriculum in Ceramic Engineering is the result of years of study and development and is designed to meet the challenge of modern civilization. The program of study encompasses a thorough grounding in the basic physical sciences and the fundamental disciplines of engineering. Processes and operations peculiar to ceramic engineering are developed from the viewpoint of interpreting and applying the underlying scientific laws, rather than empirical methods of procedure. The phenomena studied include crushing, grinding, classification and packing of particles. rheological properties of plastic masses, suspensions and slurries, drying of solids, combustion, heat tranfer, and high temperature chemical reactions. Production at lowest possible cost and improvement of processes and operations are emphasized throughout the program. Attitudes of research, experimentation and originality of thought are fostered.

Because the Department is dedicated to training young men for leadership, and because of the recognition that responsible leadership should be vested in thinking, well-oriented men, the curriculum includes a planned program of social and humanistic studies. This program is designed to prepare the student for an understanding and appreciation of his responsibilities to society, his profession, and himself, to the end that he will lead a fuller, more productive and satisfying life.

OPPORTUNITIES

Professional training in ceramic engineering provides opportunities for employment in an industry producing a wide variety of essential products including glass in all its forms, enamels and protective coatings for metals, structural clay products such as brick and tile, refractories for furnace linings, thermal insulators, electrical insulators, dielectic components, Portland cement, gypsum products, abrasives, dinnerware, art pottery, bath fixtures and hundreds of other items. In addition to these "end products" ceramics are finding ever increasing applications in the electronic, aviation, guided missile, automotive and atomic energy fields. A continuing shortage of qualified personnel in ceramic engineering has resulted in far more

employment offers than there are graduates. Initial employment upon graduation may be in the fields of research and development, in plant operation and control, and in technical sales and service. Such employment may lead to positions as directors of research, consulting and design engineers, sales directors, plant superintendents, production managers and finally administrative officers.

GEOLOGICAL ENGINEERING

Geological engineering is a technical field in which geological facts are combined with engineering techniques for the solution of problems concerned mainly with mineral raw material supply and with engineering projects. Many major engineering undertakings, such as construction of large dams and reservoirs, tunnels, and large buildings, depend for success in part on an exact knowledge of their geological setting. On the other hand, such geological problems as the economical development of mineral resources require the use of the precise methods of engineering. In the field of geological engineering, then, geology contributes data concerning the constitution, structure and history of the earth; engineering supplies quantitative, analytical methods whereby physical and chemical laws may be controlled for mankind's benefit. The Geological Engineering curriculum combines those fundamental disciplines regarded as basic to all engineering with training in the aspects of geology that are of most practical application to human affairs.

OPPORTUNITIES

A graduate in this curriculum may follow one of two broad fields of engineering, either in the United States or in foreign countries: one, the application of geology to engineering work: the other, the application of geology in the mineral industries. Geological engineers are currently employed and in demand by oil companies and quarrying concerns; exploration companies; construction firms; railroads, public utilities, banks and insurance companies; iron, steel and other metal producers; manufacturers using non-metallic mineral raw materials, as for ceramics, cement, and abrasives, municipal, state and federal government agencies; schools, colleges, museums and research institutes. The southeastern United States offers excellent opportunities for geological engineers. There is a growing need for the application of geological science to engineering construction in connection with highways, foundations, excavations, and in water supply problems. The mineral industry of the southeast has expanded substantially in the last decade; known deposits in the region, as yet only partially developed, include iron, nickel, copper, chromite, molybdenite, feldspar, mica, kaolin, cyanite, sillimanite, pyrophyllite, talc, barite, spodumene, sulphur (pyrite), coal, phosphate, granite, limestone and marl.

METALLURGICAL ENGINEERING

The undergraduate curriculum in metallurgical engineering is a standard four-year program designed to produce technically trained leaders for those industries and agencies associated with the development, production, and fabrication of metals and alloys. The major emphasis is on the application of the principles of physical and mechanical metallurgy to engineering problems encountered in these industries. Major sequence courses for the development of this emphasis are offered during the third and fourth years of the curriculum and are preceded by a well rounded program of basic and engineering sciences, and humanities. Because of this arrangement it is possible for a student to complete the first two years of his training at a suitably qualified liberal arts college and to transfer to North Carolina State College for the final two years. While such an arrangement is encouraged it is nevertheless advisable for the prospective transfer

student to seek the guidance and counsel of the Engineering School Administration at the beginning of his college career, in order to minimize difficulties associated with the transfer of credits.

OPPORTUNITIES

Opportunities open to graduates in metallurgical engineering are virtually unlimited. Each year the demand for men with metallurgical training becomes more urgent, and the number of positions presently available is several times greater than the number of graduates. A graduate metallurgical engineer may thus choose from a wide selection of companies, locations and types of work. Among the more important job opportunities open to metallurgical engineers are those in research and development of new alloys so desperately needed as materials of construction in the rapidly expanding fields of chemical, mechanical, aeronautical, and nuclear technology. With the rapid industrialization of the South and particularly the State of North Carolina, new opportunities are constantly developing for metallurgical engineers who will play a vital role in maintaining the forward progress of the State and region.

CURRICULUM IN CERAMIC ENGINEERING

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EC 205	The Economic Process	0	3
	ENG 205	Reading for Discovery	3	0
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	CH 215	Quantative Analysis	0	4
	MIM 201	Structure and Properties of Engineering Materials*	3	0
	MS 201, 202 or AS 211, 212	Military Science II or Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			18	19
3	CH 531, 532	Physical Chemistry	3	3
	EM 341	Mechanics A (Statics)	2	0
	EM 342	Mechanics B (Dynamics)	0	2
	EM 343	Strength of Materials A	0	2
	MIC 301, 302	Ceramic Operations I, II	4	3
	MIC 312	Ceramic Process Principles I	0	4
	MIG 120	Physical Geology	3	0
	MIG 330	Mineralogy	3	0
	SS 301, 302	Contemporary Civilization	3	3
		Electives	3	3
			21	20
	Summer Requirement: Six weeks' industrial employment			
4	EE 320	Elements of Electrical Engineering	0	4
	MIC 413	Ceramic Process Principles II	4	0
	MIC 414	Senior Thesis	0	3
	MIC 415, 416	Ceramic Engineering Design	2	2

* Transfer students who have satisfactorily completed the equivalent of all first and second year courses except MIM 201, and who can present acceptable electives in lieu of this course will be admitted as third year students in ceramic engineering. They will be permitted to take this course in addition to the regular third year program, substituting it for three credits of electives permitted in the third year.

	MIC 420	Industrial Ceramics	3	0
	MIC 425	Seminar	1	0
	MIC 505	Research and Control Methods	0	3
	MIG 531	Optical Mineralogy	3	0
	SS 491	Contemporary Issues	3	0
		Humanity Elective	0	3
		Electives	3	3
			19	18

PROFESSIONAL STUDY IN CERAMIC ENGINEERING — — — — — —

A fifth, or professional, year of study is offered in Ceramic Engineering as a continuation of the four-year undergraduate program. This professional year of study offers specialized advanced course work leading to the degree of Ceramic Engineer, and is especially designed for those planning a career in industrial production activities. Each program of study is designed to suit the needs of the individual student. The curriculum shown below is typical of these programs.

REGULATIONS COVERING PROFESSIONAL STUDY ARE SHOWN ON PAGES 130 and 131.

Typical Professional Program in Ceramic Engineering

			Credits	
5	IE 332	Motion and Time Study	0	4
	IE 408	Production Control	3	0
	MIC 507, 508	Advanced Ceramic Experiments	3	3
	MIC 511	Advanced Studies in Firing	3	0
	MIC 527	Refractories in Service	0	3
		Electives	6	5
			15	15

CURRICULUM IN GEOLOGICAL ENGINEERING — — — — — — —

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

2	EC 205	The Economic Process	0	3
	ENG 205	Reading for Discovery	3	0
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	CH 215	Quantitative Analysis	0	4
	MIG 120	Physical Geology*	3	0
	MS 201, 202	Military Science		
	or	or		
	AS 211, 212	Air Science	2	2
	PE 201, 202	Physical Education	1	1
			18	19

* Transfer students who have satisfactorily completed the equivalent of all first and second year courses except MIG 120, and who can present acceptable electives in lieu of this course will be admitted as third year students in geological engineering. They will be permitted to take this course in addition to the regular third year program, substituting it for three credits of electives permitted in the third year.

3	CE 201	Surveying I	3	0
	CH 531, 532	Physical Chemistry	3	3
	EM 341	Mechanics A (Statics)	2	0
	EM 342	Mechanics B (Dynamics)	0	2
	EM 343	Strength of Materials	0	2
	MIG 222	Historical Geology	3	0
	MIG 330	Mineralogy	3	0
	MIG 372	Elements of Mining Engineering	0	4
	MIG 442	Petrology	0	3
	SS 301, 302	Contemporary Civilization	3	3
		Electives	3	3
			20	20

Summer Requirements: Six weeks' industrial employment.

Or summer camp in Geological Engineering

4	EE 320	Electrical Engineering	4	0
	EM 430	Fluid Mechanics	0	2
	MIG 351	Structural Geology	3	0
	MIG 411, 412	Economic Geology	3	3
	MIG 452	Sedimentation and Stratigraphy	0	3
	MIG 462	Geological Surveying	0	3
	MIG 481, 482	Senior Seminar	1	1
	MIG 531	Optional Mineralogy	3	0
	SS 491	Contemporary Issues	3	0
		Humanities Elective	0	3
		Electives	3	3
			20	18

— — — — — — PROFESSIONAL STUDY IN GEOLOGICAL ENGINEERING

A fifth, or professional, year of study is offered in Geological Engineering as a continuation of the fourth-year undergraduate program. This fifth year of study offers specialized and advanced work leading to the degree of Geological Engineer.

Regulations Governing Professional Study are Shown on Pages 130 and 131.

Typical Professional Program in Geological Engineering

			Credits	
5	MIG 461	Engineering Geology	3	0
	MIG 522	Petroleum Geology	0	3
	MIG 552	Geophysics	0	3
	MIG 571, 572	Mining and Mineral Dressing	3	4
	MIG 581	Geomorphology	3	0
	MIG 611, 612	Advanced Economic Geology	3	3
		Electives	3	3
			15	15

CURRICULUM IN METALLURGICAL ENGINEERING — — — — — —

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EC 205	The Economic Process	0	3
	ENG 205	Reading for Discovery	3	0
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	CH 215	Quantitative Analysis	0	4
	MIM 201	Structure and Properties of Engineering Materials I*	3	0
	MS 201, 202 or AS 211, 212	Military Science or Air Science	2	2
	PE 201, 202	Physical Education	1	1
			18	19
3	CH 531, 532	Physical Chemistry	3	3
	EM 341	Mechanics A (Statics)	2	0
	EM 342	Mechanics B (Dynamics)	0	2
	EM 343	Strength of Materials	0	2
	IE 217	Machine Tools	1	0
	IE 218	Metal Forming	1	0
	MIM 331, 332	Physical Metallurgy I, II	3	3
	SS 301, 302	Contemporary Civilization	3	3
		Minor Sequence Courses	3	3
		Electives	3	3
			19	19

Summer Employment: Six weeks' industrial employment.

4	EE 320	Electrical Engineering	0	4
	EM 430	Fluid Mechanics	2	0
	MIM 401, 402	Metallurgical Operations	4	4
	MIM 431, 432	Metallography	3	3
	MIM 451, 452	Seminar	1	1
	SS 491	Contemporary Issues	3	0
		Minor Sequence Courses	3	3
		Humanities Elective	0	3
		Electives	3	3
			19	21

* Transfer students who have satisfactorily completed the equivalent of all first and second year courses except MIM 201, and who can present acceptable electives in lieu of this course will be admitted as third year students in metallurgical engineering. They will be permitted to take this course in addition to the regular third year program, substituting it for three credits of electives permitted in the third year.

PROFESSIONAL STUDY IN METALLURGICAL ENGINEERING — — — —

A fifth, or professional, year of study is offered in Metallurgical Engineering as a continuation of the four-year undergraduate program. This professional year of study offers specialized and advanced course work leading to the degree of Metallurgical Engineer, and is especially designed for those planning a career in industrial production activities. Each program of study is designed to suit the needs of the individual student. The curriculum shown on the following page is typical of these programs.

REGULATIONS COVERING PROFESSIONAL STUDY ARE SHOWN ON PAGES 130-131.

Typical Professional Program in Metallurgical Engineering

		Credits	
MIM 521, 522	Advanced Physical Metallurgy	3	3
MIM 523, 524	Metallurgical Factors in Design	2	2
MIM 445, 446	Experimental Engineering	3	3
PY 407	Modern Physics	3	0
CHE 502	Electrochemical Engineering	0	3
ME 502	Heat Transfer	3	0
ME 515	Experimental Stress Analysis	0	3
MIM 451, 452	Metallurgical Engineering Seminar	1	1
		15	15

THE PHYSICS DEPARTMENT

Professor A. C. MENIUS, JR., *Head of the Department*
Professors FORREST W. LANCASTER, J. S. MEARES, RAYMOND L. MURRAY, *Graduate Administrator;* R. H. SNYDER, NEWTON UNDERWOOD, A. W. WALTNER.
Associate Professors J. T. LYNN, R. F. STAINBACK
Assistant Professors ANTONIOS ANTONAKOS, E. J. BROWN, WILLIAM R. DAVIS
Instructors R. L. CHAPLIN, R. L. DOUGH, RAOUL M. FREYRE, MINNIE C. HARRIS, M. K. MOSS

OBJECTIVES

Physics is one of the sciences upon which Engineering and other branches of technology are based. The Department offers several general physics courses adapted to the needs of other departments and a number of advanced courses in specialized fields of physics available as electives to graduates and undergraduates of all departments.

In addition to its program of service instruction in support of and in cooperation with programs of training in other technical fields, the Physics Department offers instructional programs in two applied fields: Engineering Physics and Nuclear Engineering. Curricula have been developed in each of these fields at both the undergraduate and graduate levels.

Organization of a course of study in Nuclear Engineering, first accomplished in 1950, represented a pioneering educational venture into this new area of engineering science. Emphasis is placed on nuclear radiations and the physics of nuclear reactors.

CURRICULA

ENGINEERING PHYSICS

The curriculum in Engineering Physics is designed to provide a student with training in and a working knowledge of both general physics and basic engineering. It is anticipated that such a program will develop men with the ability to apply the principles of physics in research or in the solution of engineering problems. Theoretical and applied courses are specified, along with the humanities at the undergraduate level. In addition, elective courses in related fields of interest to the student are available.

There is a rapidly growing demand for men with practical skill and scientific training to work in the borderline field between engineering and pure physics. The Engineering Physics program is designed to meet this need.

NUCLEAR ENGINEERING

The Nuclear Engineering curriculum is offered in response to the requirements of industry and research organizations for engineers equipped with the basic knowledge of science and of nuclear technology. The curriculum is planned to include a basic core of required courses and a number of technical elective courses in engineering or mathematics.

The degree of Bachelor of Nuclear Engineering or Engineering Physics is awarded upon satisfactory completion of the prescribed four-year curricula. For those desiring further training, graduate programs terminating in a Master's or a Doctor's degree in Nuclear Engineering or Engineering Physics are offered.

CURRICULUM IN ENGINEERING PHYSICS — — — — — — — —

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EM 341	Mechanics A (Statics)	0	2
	IE 217, 218	Machine Tools and Metal Forming	1	1
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	MS 201, 202	Military Science		
	or	or		
	AS 221, 222	Air Science	2	2
	PE 201, 202	Physical Education	1	1
		Technical Electives	3	0
		Humanities	3	3
			19	18
3	EE 331, 332	Principles of Electrical Engineering	4	4
	EM 342	Mechanics B (Dynamics)	2	0
	EM 343	Strength of Materials A	0	2
	MA 401	Differential Equations	3	0
	PY 401, 402	Intermediate Physics I	4	4
	PY 407	Introduction to Modern Physics	0	3
	SS 301, 302	Contemporary Civilization	3	3
		Electives, Military or Air Science	3	3
			19	19
4	EM 430	Fluid Mechanics	0	2
	ME 301	Engineering Thermodynamics I	3	0
	PY 403, 404	Intermediate Physics II	4	4
	SS 491	Contemporary Issues I and		
		Elective in Humanities	3	3
		Technical Electives	6	8
		Electives, Military or Air Science	3	3
			19	20

CURRICULUM IN NUCLEAR ENGINEERING

FOR THE FRESHMAN YEAR, REFER TO PAGE 97.

			Credits	
2	EM 341	Mechanics A (Statics)	0	2
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	MS 201, 202	Military Science		
	or	or		
	AS 221, 222	Air Science	2	2
	PE 201, 202	Physical Education	1	1
		Technical Electives	3	0
		Humanities	3	3
			18	17
3	EM 342	Mechanics B (Dynamics)	2	0
	EM 343	Strength of Materials A	2	0
	MA 401	Differential Equations	3	0
		(Advanced Calculus or Advanced Differential Equations)	0	3
	ME 301*	Engineering Thermodynamics I	0	3
	PY 401, 402	Intermediate Physics I or		
	PY 403, 404	Intermediate Physics II	4	4
	PY 407	Introduction to Modern Physics	3	0
	PY 410	Nuclear Physics I	0	4
	SS 301, 302	Contemporary Civilization	3	3
		Electives, Military or Air Science	3	3
			20	20
4	EE 320	Elements of Electrical Engineering	4	0
	EM 430	Fluid Mechanics	0	2
	PY 419	Introduction to Nuclear Engineering	2	0
	PY 518	Radiation Hazard and Protection	3	0
	PY 520	Physical Technology in Radioactivity	0	3
	PY 530	Elementary Nuclear Reactor Theory	0	3
	SS 491	Contemporary Issues I and		
		Elective in Humanities	3	3
		Technical Electives	5	6
		Electives, Military or Air Science	3	3
			20	20

* CHE 415 Chemical Engineering Thermodynamics, may be substituted.

GRADUATE STUDY

MASTER OF SCIENCE

The Master of Science program in Engineering Physics is intended to provide advanced study in special areas of general physics, engineering and mathematics. The Master of Science program in Nuclear Engineering provides study in reactor physics, nuclear physics, engineering and mathematics. A research thesis is required for each degree. The time normally required to complete the degree is about three semesters, because of prerequisites.

Equipment available in the department for use in Master's and Doctor's research problems includes a heterogeneous nuclear reactor, homogeneous reactor and a subcritical assembly. Laboratory training is provided also by the use of these reactors.

CURRICULUM FOR MASTER OF SCIENCE IN ENGINEERING PHYSICS

		Credits
	Mathematics (above 400 level)	6
PY 601, 602	Advanced General Physics	6
PY 670	Seminar	2
PY 690	Research	4
	Electives	12
		30

CURRICULUM FOR MASTER OF SCIENCE IN NUCLEAR ENGINEERING

		Credits
	Mathematics (above 400 level)	6
PY 670	Seminar	2
PY 690	Research	4
	Electives	9
	At least three of the following courses:	9
PY 518	Radiation Hazard and Protection	
PY 610	Advanced Nuclear Physics	
PY 611	Quantum Mechanics	
PY 619	Heterogeneous Reactor Design	
PY 630	Homogeneous Reactor Design	
		30

DOCTOR OF PHILOSOPHY

In the spring of 1950 the Graduate School of the Consolidated University of North Carolina granted authority to the Physics Department of State College to enroll students for training to the doctorate level. In addition to the resources and facilities of the Physics Department, those of other departments at State College and of the Physics and Mathematics Departments of the University of North Carolina at Chapel Hill are available to these advanced students as their particular programs may require. Facilities are most extensive for work in the general fields of applied nuclear physics. The usual rules and regulations of the Graduate School apply to students enrolled in the doctorate program in Physics. For general regulations, the Graduate School Catalog should be consulted.

THE PROFESSIONAL PROGRAM IN ENGINEERING — — —

The School of Engineering offers fifth-year professional curricula leading to the degrees Ceramic Engineer, Civil Engineer, Chemical Engineer, Electrical Engineer, Geological Engineer, Industrial Engineer and Mechanical Engineer. These curricula are tailor-made to fit the particular needs of each student with a view that upon completion of a program the student will be prepared to pursue a professional career in engineering.

It is the intent of the fifth-year program to emphasize professional course work rather than research. To this end, a curriculum is comprised of 30 semester credits of course work requiring of the student a minimum of one academic year in residence; neither a thesis nor a reading knowledge of a foreign language is required. Samples of curricula that meet the requirements of the fifth-year program may be found under the appropriate Departmental curricula. These curricula are to be considered illustrative; the actual programs of study will be especially designed to fit the needs of the individual student.

ADMISSION

Applicants who hold the bachelor's degree in engineering from recognized colleges 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 fifth-year course requirements.

Applications for admission, accompanied by full credentials in the form of transcripts of academic records, should be filed in the office of the Dean of Engineering at least thirty 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 College, who plans to undertake a professional program and who has fulfilled all requirements for the bachelor's degree except one or two courses, may be permitted to enroll in certain courses and later obtain credit toward the professional degree provided the student gives notice of his purpose to the Dean of the School of Engineering. The maximum credit to be obtained in this way is 6 semester course credits.

2. Credit for professional work to be applied toward the requirements for the professional degree, not to exceed 6 semester credits, may be transferred to North Carolina State College from recognized institutions of university grade offering advanced work in engineering and related fields. Such a transfer of credit must be recommended by the head of the department in which the student does his major work and it must be approved by the Dean of Engineering.

3. Fifth-year students are classified as post-baccalaureate students and are subject to rules and regulations as established and administered by the Dean of Engineering.

4. Grades for each completed course are reported to the Dean of Engineering and to the Office of Registration. 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 fifth-year student will be assigned to a committee consisting of his department head and the professor in charge of the work in which he is majoring. The function of this committee is to assist the student in preparing a program of study and to counsel him in his academic work. The student will be required, with the assistance of his committee, to prepare a complete plan of study before mid-semester of his first semester in residence. This program of study is subject to the approval of the Dean of Engineering.

SCHOOL OF FORESTRY

RICHARD J. PRESTON, DEAN

Professor J. V. HOFMANN, *Director Emeritus and Manager North Carolina Forestry Foundation*

Professors J. S. BETHEL, R. C. BRYANT, R. M. CARTER, C. E. LIBBY, T. E. MAKI, G. K. SLOCUM

Associate Professors W. D. MILLER, B. J. ZOBEL

Assistant Professors A. C. BAREFOOT, H. D. COOK, C. A. HART, R. G. HITCHINGS, R. J. THOMAS

Geneticist R. L. MCELWEE

INTRODUCTORY

While forestry has been recognized and practiced for centuries in Europe, this profession is relatively new in the United States, dating from about the beginning of the present century. During the period of rapid expansion and development of our country the forests were badly neglected and abused. Now, however, with our timber supplies depleted and the value of timber products increasing, sound forest practices have been accepted as economically desirable and feasible. Increasing the productivity and quality of our forests is basic to the welfare of the Southeast. The importance of the forest resource in the economy of North Carolina is brought out by the fact that sixty-two per cent of the land area is in forest, with wood products industries ranking next to textiles as a source of industrial employment.

Through a program which offers a broad training in the physical and biological sciences as well as a sound cultural background, the School of Forestry prepares students for service in the two major professional fields of forest management and wood utilization.

CURRICULA

The School offers undergraduate instruction leading to the degree of Bachelor of Science in the two major professional fields of forest management and wood utilization, the latter including Wood Technology, Pulp and Paper Technology and Wood Products Merchandising. All curricula have a common freshman year thus enabling the student to postpone selection of a major field until he has had an opportunity to become acquainted with its scope and possibilities.

Forest Management deals with all phases of the management of wild lands and includes such related subjects as water-shed protection, wildlife management and recreation. In order that the student may be adequately prepared for work of such diverse nature, the curriculum provides training in such subjects as silviculture, timber estimating, management, fire prevention and control, forest pathology, insect control, forest soils, economics and other aspects of land use.

The course of study in Wood Technology, which is concerned with the technical aspects of utilization, includes training in all types of wood using and wood manufacturing industries. It incorporates technical and practical principles of logging, milling, seasoning, gluing, preserving, finishing, fabricating and machining.

Pulp and Paper Technology trains men for work in pulp and paper plants. Students are given thorough training in chemistry, mathematics,

physics, wood structure and properties, pulping processes and engineering subjects related to pulp and paper manufacturing.

Wood Products Merchandising covers the distribution, selling and use of lumber and of products made from wood. This curriculum combines a broad background of business administration with a sound knowledge of the products being handled.

DEGREES

The Bachelor of Science degree is conferred upon completion of any of the four-year curricula in the areas mentioned above.

Professional preparation beyond the four-year curricula is desirable, and qualified students are urged to plan a five-year program leading to the Master's degree. For students desiring a thorough professional background, the School offers the degree of Master of Forestry or of Master of Wood Technology; the degree of Master of Science in these two fields is offered for those desiring specialization in the fields of scientific research.

The degree of Doctor of Philosophy is offered in several fields in forestry.

Further information regarding graduate study is contained in the Graduate School Catalog which may be obtained from the Dean of the Graduate School.

FACILITIES AND PROGRAMS

The School of Forestry is housed in Kilgore Hall on the west side of the campus. This new forestry building provides outstanding classroom and laboratory facilities.

WOOD PRODUCTS LABORATORY

The Wood Products Laboratory, housed on the first floor of the new Forestry Building and in separate buildings on Western Boulevard, contains general wood shop equipment, a veneer lathe and clipper, glue mixers and spreaders, tape machine and hot presses, testing equipment, preservation tanks, a modern dry kiln, and two portable sawmills. This equipment, available for teaching, student experience and research, provides an unexcelled laboratory for practical production processing of dimension stock, furniture, plywood and other wood products.

PULP AND PAPER LABORATORY

The recently completed Pulp and Paper Laboratory located on Western Boulevard provides modern offices and classrooms as well as laboratories for pulping, paper making, paper and pulp testing, coloring and fiber analysis.

SCHOOL FORESTS

The School of Forestry, with more than 82,000 acres of forest land available and three permanent field camps, has facilities unexcelled in many respects for field instruction and research.

The Hofmann Forest, owned and operated by the North Carolina Forestry Foundation for the benefit of the School of Forestry, consists of approximately 78,000 acres located in Jones and Onslow counties in the southeastern portion of the state. Pond and loblolly pine together with hardwood and cypress swamps characterize this tract. Part of the spring semester of the Senior year is spent in the permanent camp located in this forest.

The George Watts Hill Demonstration Forest is a tract of 1,500 acres located sixteen miles north of Durham. This typically piedmont forest of rolling terrain contains stands of loblolly, shortleaf and Virginia pines along with numerous hardwoods. The permanent summer camp for sophomores is located in this area.

FORESTRY

The Wayah Recreational Area in the North Carolina National Forest near Franklin is located in a typical mountain forest. Facilities at this area have been leased from the Government. Portions of the spring semester of the Senior year and of the sophomore summer camp are held in permanent quarters on this mountain tract.

The Richland Creek Farm Forest of 300 acres located four miles northwest of the campus is being developed into a model farm forest and is used for field instruction near the campus.

The Hope Valley Forest is a 1700-acre tract located five miles southeast of Chapel Hill and is used for instruction and research.

The School nursery, located on the campus, is fully equipped for instruction purposes and the production of planting stock.

FIELD INSTRUCTION AND EXPERIENCE

All students are required to present a minimum of one summer of acceptable work experience in order to meet the graduation requirements. Students are required to consult with their advisers regarding the types of employment that will be acceptable.

The ten-week Sophomore summer camp is a general requirement for students in the Forest Management, Wood Technology and Wood Products Merchandising curricula. Students in the Forestry Management curriculum are also required to attend camp during the last half of the spring semester of the Senior year. Permanent, well-equipped camps are maintained in coastal, piedmont and mountain forests. A "C" average is required for admission to these camps.

Additional field instruction and scheduled trips to representative wood industries are required of all students as a part of their class assignments. To cover the costs of this off-campus training, all students enrolled in the School of Forestry pay a field laboratory fee of $10.00 each year at the time they first register for the school year. Room rent of $20.00 is charged for both the summer and spring camps.

OPPORTUNITIES

A wide and rapidly expanding field of employment possibilities is available in the Southeast to young men trained in forestry. Until recent years most job opportunities were with government agencies in managing public forests, and this still constitutes a major source of employment. These agencies include state and federal forest services, extension services, and other groups such as the Soil Conservation Service and the Tennessee Valley Authority.

In recent years job opportunities with private industries have expanded greatly. Increasing numbers of technically trained young men are entering a wide variety of professional positions in the fields of forest land management, watershed management, logging, sawmilling, veneer and plywood manufacturing, pulp and paper making, kiln drying, wood preservation and the manufacture of wood products such as furniture, dimension stock and various prefabricated items.

The merchandising of lumber and lumber products offers numerous opportunities for students qualified for sales, business administration or small building construction. Sawmills and lumber yards, plywood and paper manufacturers, and flooring, wallboard and other forest products plants need trained men.

Exceptional students will find opportunities for employment in research or teaching. This type of work ordinarily requires a graduate degree. There has been an increasing demand for well-trained woodlands managers and wood technologists, as well as for research workers in government experiment stations and laboratories.

Over eighty per cent of the graduates of the School of Forestry are now employed in some field of forest or wood products work. The few students who have not followed the forestry profession have found their college education sufficiently broad to provide a sound basis for a wide variety of work.

SHORT COURSES

In cooperation with the College Extension Division and other departments of State College, short courses are offered to personnel in wood-using industries. These courses vary from a few days to a few weeks in length and cover such subjects as aerial photo interpretation, lumber merchandising, seasoning and kiln drying, lumber grading, gluing, wood preservation, and quality control and wood finishing. Additional courses in other fields of forestry will be offered as the need arises. In addition to the faculty of the School of Forestry, experts from the trade associations, federal laboratories and private industry are called in to furnish instruction. Class and laboratory facilities of State College are available for these courses. These vocational courses provide to men in industry an opportunity to keep abreast of modern developments in methods and equipment.

FELLOWSHIPS, SCHOLARSHIPS, AND LOAN FUNDS

A number of undergraduate scholarships, research assistantships and teaching fellowships are available to qualified students. Students interested in applying should write to the Dean of the School of Forestry.

The Hofmann Loan Fund was established by alumni of the School of Forestry to honor Dr. J. V. Hofmann, the first Director of the Division. Loans to worthy students are available through the Student Loan Fund established by the State College Alumni Association.

Many students help pay their expenses through part-time work at the College or in town. The Self-Help Secretary of the College Y.M.C.A. assists in locating employment.

COURSES OF STUDY IN THE SCHOOL OF FORESTRY

FOR ALL FORESTRY CURRICULA

1	BO 101, 102	General Botany	3	3
	CH 101, 103 or	General Inorganic Chemistry; General and Qualitative Chemistry; or		
	CH 203*	General and Organic Chemistry	4	4
	ENG 111, 112	Composition	3	3
	FOR 101, 102	Introduction to Forestry	2	2
	MA 111, 112**	Algebra and Trigonometry; Analytic Geometry and Calculus A	4	4
	MS 101, 102 or	Military Science I or		
	AS 121, 122	Air Science I	2	2
	PE 101, 102	Physical Education	1	1
			19	19

* All students take Chem. 101, Inorganic Chemistry first; students in Forest Management or Wood Products Merchandising will take Chem. 203. Organic Chemistry, the second semester, students in Pulp and Paper Technology and Wood Technology will take Chem. 103, Qualitative Analysis.

** Students in Wood Technology and Pulp and Paper Technology who have studied Solid Geometry in High School should take MA 101 and 102.

FOREST MANAGEMENT

Professor T. E. MAKI, *In Charge*

OBJECTIVES

Forest Management is the application of business methods and technical forestry principles to the operation of forest properties. This field requires a knowledge of individual trees and timber stands, of different forest types

and entire forest areas, as well as of the basic biological relationships within the forests. It also requires a knowledge of land surveying, timber cruising, measurement of forest products, and of the economic factors involved in the business of growing wood crops.

CURRICULUM

The curriculum in Forest Management is organized to provide a broad basic training and also to permit limited specialization. To accomplish the latter goal, the curriculum includes 30 elective credits. At the beginning of his junior year, the student selects one of the five areas of specialization listed and chooses courses listed under this field for his elective credits.

The curriculum leads to the degree of Bachelor of Science in Forest Management. A minimum of 157 credits is required for graduation.

OPPORTUNITIES

Students who complete the curriculum are trained for positions with pulp companies, lumber companies and other private landowners; federal and state forest services; agricultural extension; and for private enterprise as consultants, forest landowners or sawmill operators.

CURRICULUM IN FOREST MANAGEMENT

			Credits	
2	SOI 200	Soils	0	4
	BO 211, 212	Dendrology	2	2
	CE 217	Forestry Surveying	0	4
	EC 201	Economics	3	0
	FOR 201	Wood Structure and Properties I	3	0
	PY 211	General Physics	4	0
		Social Science Electives	3	3
	ZO 102	General Zoology	0	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			18	19
		SUMMER CAMP		
	FOR S204	Silviculture		2
	FOR S214	Dendrology		2
	FOR S224	Forest Mapping		2
	FOR S264	Protection and Utilization		2
	FOR S274	Mensuration		2
				10
3	BO 421	Plant Physiology	4	0
	ENG 321	Scientific Writing and English Elective	3	3
	ENT 301	Introduction to Forest Insects	3	0
	FOR 361	Silvics	0	3
	FOR 372	Mensuration	3	0
	PP 318	Diseases of Forest Trees	0	3
		Social Science Elective	0	3
		Electives	6	6
			19	18

			Credits	
4	FOR 404	Management Plans (Camp)	0	3
	FOR 405	Forest Inventory (Camp)	0	2
	FOR 406	Forest Industries (Camp)	0	2
	FOR 407	Field Silviculture (Camp)	0	2
	FOR 423	Logging and Milling	3	0
	FOR 501	Forest Valuation	3	0
	FOR 511	Silviculture (8 weeks)	0	3
	FOR 512	Forest Economics	3	0
	FOR 531	Forest Management (8 Weeks)	0	3
	FOR 553	Forest Photogrammetry (8 Weeks)	0	2
	ST 311	Introduction to Statistics	3	0
		Elective	6	0
			18	17

FOREST MANAGEMENT, FIELDS OF SPECIALIZATION

A student should select one of the following fields of specialization and choose elective courses from those listed under each field.

GENERAL FORESTRY

		Credits		
BO 441	Plant Ecology	3		0
FOR 422	Forest Products	3		0
FOR 452	Forest Grazing	2		0
FOR 462	Artificial Forestation	0		2
FOR 472	Forest Policy and Administration	2		0
MIG 120	Physical Geology	3	or	3
RS 301	Sociology of Rural Life	3	or	3
ZO 312	Game Management	3		0

UTILIZATION

FOR 202	Structure and Properties II	0		2
FOR 303	Wood-Moisture Relations	0		2
FOR 401	Wood Preservation	0		2
FOR 433	Gluing and Plywood	3		0
FOR 441	Mechanical Properties of Wood	3		0
FOR 442	Furniture Construction and Assembly	3		0
FOR 443	Wood Finishing	0		3
FOR 481	Pulping Processes and Products	2		0

FOREST WILDLIFE MANAGEMENT

BO 441	Plant Ecology	3		0
FOR 452	Forest Grazing	2		0
ZO 101	General Zoology	3	or	3
ZO 252	Ornithology	0		3
ZO 301	Animal Physiology	3	or	3
ZO 521	Fishery Biology	3		0
ZO 522	Animal Ecology	0		3
ZO 544	Mammology	0		3
ZO 551, 552	Wildlife Management	3		3

FOREST NURSERY PRACTICE

AGE 321	Irrigation, Drainage & Terracing	4		0
SOI 341	Soil Fertility & Management	0		3
FC 414	Weeds and Their Control	0		3
BO 312	General Bacteriology	4	or	4

FORESTRY

BO 532, 533	Advanced Plant Physiology	2		2
EC 401, 402	Principles of Accounting	3		3
ENT 571	Forest Entomology	3		0
GN 411	Principles of Genetics	3	or	3
HRT 301	Plant Propagation	3	or	3
HRT 311	Nursery Practice	3		0
HRT 481	Breeding of Horticulture Plants	3		0

PARKS AND RECREATION

BO 403	Systematic Botany	0		3
MIG 120	Physical Geology	3	or	3
PSY 200	Introduction to Psychology	3	or	3
RS 301	Sociology of Rural Life	3	or	3
SOC 202	Man and Society (General Sociology)	3	or	3
ZO 101	General Zoology	3	or	3
ZO 252	Ornithology	0		3
ZO 544	Mammalogy	0		3

GRADUATE OR RESEARCH

BO 403	Systematic Botany	0		3
BO 441	Plant Ecology	3		0
CH 103	General and Qualitative Chemistry	4	or	4
CH 215	Quantitative Analysis	4	or	4
MA 211, 212	Analytic Geometry and Calculus B, C	3		3
ML	Foreign Language	3		3
PY 212	General Physics	4		4

WOOD TECHNOLOGY

Professor R. M. CARTER, *In Charge*

CURRICULUM

The Wood Technology Curriculum trains men for many assignments in manufacturing wood products. It involves a basic knowledge of the sciences combined with business economics. Experience in wood manufacturing methods is gained by student operation of modern production equipment in the Wood Products Laboratory. In addition, all students graduating from this curriculum must have a minimum of one summer's acceptable work experience.

An opportunity for student selection of courses to meet special interests is provided through 40 elective credits. At the beginning of the Junior year, each student selects one of the three listed fields of specialization and chooses for many of his elective credits courses listed under this field.

This curriculum leads to the degree of Bachelor of Science in Wood Technology. A minimum of 158 credits is required for graduation.

OPPORTUNITIES

A career with wood industries offers a variety of opportunities for young men trained in wood properties, manufacturing operations and business methods. The application of new processes and materials in the conversion of timber into the thousands of wood products has created a demand for technically trained men. Companies manufacturing lumber, veneer and plywood, hardwood dimension stock, furniture, millwork, flooring, pianos, caskets, wood turnings, adhesives, preservatives, finishing materials and composition boards are types of industries interested in employing graduates.

CURRICULUM IN WOOD TECHNOLOGY

			Credits	
2	CH 203	Organic Chemistry	0	4
	EC 201	Economics	3	0
	FOR 201	Wood Structure and Properties I	3	0
	FOR 303	Wood-Moisture Relations	0	3
	IE 224	Wood Working Equipment	0	3
	MA 211, 212	Analytic Geometry and Calculus B, C	3	3
	ME 101	Engineering Graphics	2	0
	PY 211, 212	General Physics	4	4
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			18	20

SUMMER CAMP

S*	FOR S204	Silviculture	2
	FOR S214	Dendrology	2
	FOR S224	Forest Mapping	2
	FOR S264	Protection and Utilization	2
	FOR S274	Mensuration	2
			10

3	ENG 231	Basic Speaking Skills	0	3
	FOR 202	Wood Structure and Properties II	0	2
	FOR 423	Logging and Milling	3	0
	FOR 433	Gluing and Plywood	3	0
	FOR 441	Mechanical Properties of Wood	3	0
	ST 361	Introduction to Statistics for Engineers	0	3
		Social Science Electives	3	3
		Electives	6	7
			18	18

4	FOR 401	Wood Preservation	0	2
	FOR 402	Foundations of Forest Management	2	0
	FOR 442	Furniture Construction and Assembly	3	0
	FOR 443	Wood Finishing	0	3
	FOR 444	Introduction to Quality Control	0	3
	FOR 512	Forest Economics	3	0
		English Elective	0	3
		Social Science Elective	3	0
		Electives	8	6
			19	17

* Students with comparable experience, upon faculty approval, may substitute one additional summer's work experience for Summer Camp. After completion of 12 weeks of plant experience and presentation of a satisfactory report three hours of academic credit will be granted.

WOOD TECHNOLOGY, FIELDS OF SPECIALIZATION — — — — — — —

A student should select one of the following fields of specialization. Courses marked with an asterisk (*) are required. Technical electives should be scheduled from the remaining courses listed in the field of specialization.

HARDWOOD DIMENSION AND LUMBER

		Credits		
EC 401, 402*	Principles of Accounting	3		3
EC 425	Industrial Management	3		0
EC 426	Personnel Management	0		3
EC 431	Labor Problems	3	or	3
EC 432	Industrial Relations	3	or	3
EC 504, 505*	Principles of Cost Accounting	3		3
EE 350	Electrical Applications in Wood Products	0		3
ENG 211*	Business Communications	3	or	3
FOR 372	Mensuration	3		0
FOR 422	Forest Products	3		0
FOR 431*	Dimension Stock Manufacturing	3		0
IE 322	Furniture Design and Construction	2		0
IE 332*	Motion and Time Study	0		4
IE 341	Furniture Plant Layout and Design	3		0
IE 408*	Production Control	3		0
PSY 337	Industrial Psychology I	3	or	3

VENEER AND PLYWOOD

CHE 543	Technology of Plastics	0		3
CH 215	Quantitative Analysis	4	or	4
CH 425, 426	Organic Chemistry	3		3
EC 401*	Principles of Accounting	3		0
EC 426	Personnel Management	0		3
EC 504*	Principles of Cost Accounting	3		0
EE 350*	Electrical Applications in Wood Products	3		0
FOR 422	Forest Products	3		0
FOR 431	Dimension Stock Manufacturing	3		0
FOR 432	Merchandising Forest Products	2		0
FOR 481	Pulping Processes and Products	2		0
FOR 513*	Tropical Woods	0		2
IE 332	Motion and Time Study	0		4
IE 408	Production Control	3		0
IE 430	Job Evaluation and Wage Administration	0		3
ME 304*	Fundamentals of Heat Power	3		0
PSY 337	Industrial Psychology I	3	or	3

RESEARCH AND DEVELOPMENT

BO 410	Plant Histology and Microtechnique	3	0
CHE 301, 302	Elements of Chemical Engineering	3	3
CHE 543	Technology of Plastics	0	3
CH 451	Introductory Biochemistry	3	0
CH 425, 426	Organic Chemistry	3	3
EE 350	Electrical Applications in Wood Products	0	3
FOR 422	Forest Products	3	0
FOR 481	Pulping Processes and Products	2	0
FOR 513	Tropical Woods	0	2
FOR 542	Fiber Analysis	0	2
MA 401	Differential Equations	3	0
ME 304	Fundamentals of Heat Power	3	0
ML	Modern Languages	3	3
PY 401, 402	Intermediate Physics I	4	4
ST 515, 516	Experimental Statistics for Engineers	3	3

PULP AND PAPER TECHNOLOGY

Professor C. E. LIBBY, *In Charge*

CURRICULA

The curriculum in Pulp and Paper Technology trains men for technical work in the rapidly growing pulp and paper industry. Graduates are prepared for careers as pulp technologists, paper mill chemists, quality control specialists and mill superintendents. After a thorough background in basic sciences, the program offers special work in wood pulping processes, chemical and by-products recovery, pulp bleaching and the various papermaking operations such as refining, sizing, filling, coloring, coating and converting.

The pulp and paper industry ranks fifth among all American industries. In 1955 pulp and paper products were valued at 9.9 billions of dollars and the industry employed more than 400,000 skilled workers in the mills. This is primarily a Southern industry with 56 per cent of the nation's pulpwood produced in the South.

Financially supported by more than 70 major companies, this program was created to meet the critical need for trained men. It is a regional program and has been approved by the Southern Regional Education Board as the one undergraduate program to serve the Southeast in this field. A number of attractive scholarships are available. The new $425,000 Robertson Laboratory of Pulp and Paper Technology provides this program with outstanding facilities.

All students majoring in this curriculum are excused from the sophomore summer camp required of other forestry students but are required to spend this summer working in a pulp or paper mill where arrangements have been made by the college for such employment. Three hours of academic credit are granted the student after completion of 12 weeks of mill work and presentation of a satisfactory report covering this work experience. In addition to this minimum summer work requirement, students are urged to work in mills the two remaining summers between academic years because of the great value of practical experience in this industry.

This curriculum leads to the degree of Bachelor of Science in Pulp and Paper Technology. A minimum of 157 credits is required for graduation.

CURRICULUM IN PULP AND PAPER TECHNOLOGY

			Credits	
2	CH 215	Quantitative Analysis	4	0
	ENG 321	Scientific Writing	0	3
	FOR 201, 202	Wood Structure and Properties I, II	3	2
	MA 211, 212	Analytic Geometry and Calculus B, C	3	3
	ME 101, 102	Engineering Graphics I, II	2	2
	PY 211, 212	General Physics	4	4
	PSY 200	Introduction to General Psychology	0	3
	MS 201, 202	Military Science II		
	or	or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education	1	1
			19	20

			Credits	
S	FOR 591	Forestry Problems—Mill Experience		3
3	CHE 301, 302	Elements of Chemical Engineering	3	3
	CH 425, 426	Organic Chemistry	3	3
	CH 531, 532	Physical Chemistry	3	3
	EE 350	Electrical Applications in Wood Products Manufacturing	0	3
	ENG 231	Basic Speaking Skills	3	0
	FOR 321, 322	Pulp and Paper Technology	3	3
	FOR 542	Fiber Analysis	0	2
	ME 304	Fundamentals of Heat Power	3	0
		Electives	2	2
			20	19
4	EC 201	Economics	3	0
	FOR 403	Paper Technology Laboratory	0	3
	FOR 411, 412	Pulp and Paper Mill Equipment	3	2
	FOR 413	Paper Testing Laboratory	2	0
	FOR 451	Paper Coloring Laboratry	2	0
	FOR 461	Paper Converting	1	0
	FOR 463	Plant Inspections	0	1
	FOR 471	Pulp Technology Laboratory	4	0
	FOR 482	Pulp and Paper Mill Management	0	2
	FOR 591	Research Problem	1	4
	TC 511	Chemistry of Fibers	0	2
		General Electives	3	2
		Social Science Elective	0	3
			19	19

WOOD PRODUCTS MERCHANDISING

Professor R. M. CARTER, *In Charge*

CURRICULUM

The distribution of lumber and other wood products and their proper utilization comprises the third curriculum of the wood technology-utilization branch of forestry. It is intended to fill the need for personnel trained both in business methods and in the basic characteristics and properties of the products and structures made out of wood. Methods of manufacturing, merchandising, business administration, preparation of plans and specifications and a knowledge of other building materials form an integral part of the curriculum.

An opportunity for student selection of courses to meet special interests is provided through 27 elective credits. At the beginning of the Junior year each student selects one of the three fields of specialization listed and chooses for many of his elective credits courses listed under this field.

This curriculum leads to the degree of Bachelor of Science in Wood Products Merchandising. A minimum of 158 credits is required for graduation.

OPPORTUNITIES

This curriculum trains men in light building construction, wood products manufacturing and merchandising for a wide variety of production and marketing positions with sawmills; retail and wholesale lumber yards, or brokerage firms; plywood and paper manufacturers; roofing felt, wallboard, flooring and furniture plants; and industries providing trade outlets for other wood products and associated materials.

CURRICULUM IN WOOD PRODUCTS MERCHANDISING

			Credits	
2	CE 217	Forestry Surveying	0	4
	EC 201	Economics	3	0
	ENG 231	Basic Speaking Skills	3	0
	FOR 201	Wood Structure and Properties I	3	0
	FOR 303	Wood Moisture Relations	0	3
	IE 224	Wood Working Equipment	0	3
	ME 101, 102	Engineering Graphics I, II	2	2
	PY 211, 212	General Physics	4	4
	MS 201, 202	Military Science		
	or	or		
	AS 221, 222	Air Science	2	2
	PE 201, 202	Physical Education	1	1
			18	19
		SUMMER CAMP		
S*	FOR S204	Silviculture		2
	FOR S214	Dendrology		2
	FOR S224	Forest Mapping		2
	FOR S264	Protection and Utilization		2
	FOR S274	Mensuration		2
				10
3	EC 202	Economics	3	0
	EC 315	Salesmanship	0	2
	EC 407	Business Law	0	3
	EC 411	Marketing Methods	3	0
	FOR 202	Wood Structure and Properties II	0	2
	FOR 423	Logging and Milling	3	0
	FOR 433	Gluing and Plywood	3	0
		English Elective	0	3
		Electives	6	8
			18	18

			Credits	
4	EC 401, 402	Principles of Accounting	3	3
	EC 425	Industrial Management	3	0
	EC 426	Personnel Management	0	3
	FOR 401	Wood Preservation	0	2
	FOR 402	Foundations of Forest Management	2	0

FOR 432	Merchandising Forest Products	2	0
FOR 441	Mechanical Properties of Wood	3	0
FOR 453	Lumber Structures	0	3
FOR 512	Forest Economics	3	0
	Electives	3	7
		19	18

* Students with comparable experience, upon faculty approval, may substitute one additional summer's work experience for Summer Camp. After completion of 12 weeks of plant experience and presentation of a satisfactory report, three hours of academic credit will be granted.

WOOD PRODUCTS MERCHANDISING, FIELDS OF SPECIALIZATION — — —

A student should select one of the following fields of specialization. Courses marked with an asterisk (*) are required. Technical electives should be scheduled from the remaining courses listed in the field of specialization.

BUILDING MATERIALS

		Credits		
CE 351*	Details of Building Construction	2		0
CE 361*	Estimates and Costs I	3		0
EC 415*	Advertising	2	or	2
EC 420	Corporation Finance	3		0
EC 432	Industrial Relations	3	or	3
EC 501	Advanced Economic Theory	0		3
EE 350	Electrical Applications in Wood Products	0		3
ENG 332*	Argumentation and Persuasion	3		0
FOR 422	Forest Products	3		0

TECHNICAL SALES AND SERVICE

CHE 205	Chemical Process Principles I	0		4
CHE 543	Technology of Plastics	0		3
EC 412	Sales Management	0		3
EC 415*	Advertising	2	or	2
EC 420	Corporation Finance	3		0
EC 521	Office Management	3	or	3
EE 350	Electrical Applications in Wood Products	0		3
ENG 332*	Argumentation and Persuasion	3		0
FOR 422*	Forest Products	3		0
FOR 443	Wood Finishing	0		3
FOR 444	Introduction to Quality Control	3		0
FOR 481	Pulping Processes	2		0
MA 211, 212*	Analytic Geometry and Calculus B, C	3		3
ME 304	Fundamentals of Heat Power	3		0
ST 361	Introduction to Statistics for Engineers	3	or	3

LUMBER AND PLYWOOD

EC 415*	Advertising	2	or	2
EC 420	Corporation Finance	3		0
EC 432	Industrial Relations	3	or	3
ENG 332*	Argumentation and Persuasion	3		0
FOR 422*	Forest Products	3		0
FOR 443	Wood Finishing	0		3
FOR 444*	Introduction to Quality Control	3		0
FOR 513*	Tropical Woods	0		2
ST 361*	Introduction to Statistics for Engineers	3	or	3

SCHOOL OF GENERAL STUDIES

C. ADDISON HICKMAN, DEAN

INTRODUCTORY

When it became the Land-Grant College of North Carolina, State College inherited a long tradition of education, calling for furnishing maximum service to all the citizens of the state. Its progress from the first, therefore, embraced the finest technical training based on the most thorough research, coupled with the humane and social studies necessary in developing individuals of the highest character and civic responsibility. From the beginning, State College, like other Land-Grant colleges, has taken as its goal this two-fold function: training men of professional and technical leadership who are at the same time men of social leadership, whole men able to live as enlightened free citizens in our democratic state.

With the consolidation of the State College into the University of North Carolina in 1935, this double function was given further recognition. A Basic Division was formed which, without granting degrees in liberal arts, was to form a broad base on which all technical education was to be built. Specifically, the Basic Division was charged with instruction in the fields of humanities and social sciences, physical education and recreation, and was committed to provide the opportunities in general education necessary for a well-rounded program in all the technical fields pursued by State College students. In this, the Basic Division was in effect an integral part of all the technical schools, since it brought to bear on all students of all academic years the impact of instruction in the area of the humanities and social sciences to implement instruction in technical and professional subjects in the degree-granting Schools. That this instruction was deemed significant at State College is shown by the fact that the portion of curricular time devoted to these studies gradually increased until more than one-fourth of class instruction was done in the areas embraced by the Basic Division. Further recognition of the importance of the general education of technical students came with the action of the Board of Trustees in May, 1952, when the Basic Division was renamed the School of General Studies and placed on an equal basis with the technical schools of State College.

OBJECTIVES

The over-all objectives of the School of General Studies have become clear through the years. Its purposes are: to develop the student's communication and reading skills through the study of language and literature; to increase his understanding of the complex economic, social, political, and philosophical world in which he will live and work; to develop in him a sense of social responsibility as a scientist and technical leader in the world of technology and science; to teach him to think critically and scientifically in the social world of men as he does in the material world of his profession; to quicken his appreciation of the role played by both science and the arts in human affairs. Beyond the fundamental training in these fields as required by the technical curricula of the Schools, the School of General Studies also provides additional elective work in these areas so that each student may pursue further his own interests.

GENERAL STUDIES

ORGANIZATION — — — — — — — — — — — — — —

The School of General Studies includes the Departments of Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Physical Education, Social Studies, and Sociology and Anthropology. The Dean and the department heads constitute the Administrative Board of the School of General Studies. This Board works with the School Faculty in matters of policy and instruction.

THE DEPARTMENT OF ECONOMICS — — — — — — —

Professor C. ADDISON HICKMAN, *Acting Head of the Department*
Professors R. O. MOEN, C. B. SHULENBERGER, T. W. WOOD.
Associate Professors E. A. FAILS, CLEON HARRELL, B. M. OLSEN
Assistant Professors CATHERINE W. ABRUZZI, A. J. BARTLEY, T. HARDIE PARK, V. A. PIKNER, CHING-SHENG SHEN, O. G. THOMPSON
Lecturers D. R. DIXON, J. A. LYONS, HERBERT VON BECKERATH
Instructors ALISONE M. CLARKE, DELL B. JOHANNESEN, N. E. PILAND

The Department of Economics seeks to help students understand the economic process, the nature and functioning of the economy and useful approaches to and methods of economic analysis. In pursuance of this end the department has a representative offering of courses in the major fields of economic theory, applied economics and business operation at both undergraduate and graduate levels. Several courses have been designed primarily for students working toward advanced degrees in the technical schools. Members of the department are also engaged in extension work and economic research.

THE DEPARTMENT OF ENGLISH — — — — — — — —

Professor LODWICK HARTLEY, *Head of the Department*
Professors J. D. CLARK, A. M. FOUNTAIN, A. I. LADU, R. P. MARSHALL, J. W. SHIRLEY, R. G. WALSER
Associate Professors P. H. DAVIS, H. G. KINCHELOE, E. H. PAGET, D. J. RULFS, A. B. R. SHELLEY, J. SUBERMAN, L. H. SWAIN, R. B. WYNNE
Assistant Professors WILLIAM BARNHART, H. G. ELDRIDGE, JR., SADIE J. HARMON, B. G. KOONCE, JR., F. H. MOORE, L. R. WHICHARD, P. WILLIAMS, JR.
Instructors L. H. ANTONAKOS, J. H. GILBERT, R. W. GOLDSMITH, HAZEL GRIFFIN, MAX HALPEREN, A. S. KNOWLES, L. F. LADD, UMPHREY LEE, JR., C. W. MARTIN, MATTIE E. PARKER, JACK PORTER, N. G. SMITH, HULDA B. TURNER, MARILYN WILLIAMSON

The English Department has, as its primary objective, instruction in the basic communication skills: reading, writing, and speaking. To this end it offers a course in the fundamentals of composition which attempts to combine the three skills, plus special courses in business and technical communications and in speech. As an additional function, the department provides a core of humanistic studies consisting of courses in English, American and World literature. The principal objective of these courses is to make the student aware of his cultural heritage and to develop in him good habits of leisure reading.

THE DEPARTMENT OF HISTORY AND POLITICAL SCIENCE

Professor PRESTON W. EDSALL, *Head of the Department*
Professors S. NOBLIN, P. M. RICE
Associate Professors L. W. BARNHARDT, M. L. BROWN, JR., A. HOLTZMAN, L. W. SEEGERS
Assistant Professors B. F. BEERS, W. J. BLOCK, C. F. KOLB, L. F. REITZER
Instructor J. L. HELGUERA

An understanding of the historical background of our times and of political principles and governmental systems is expected of the educated man. This department, by giving specially designed courses, both elective and required, seeks to aid students in gaining this understanding. While most courses offered in history and political science are designed for undergraduates, the department offers a few graduate courses which may be built into the programs of students working for advanced degrees. It also cooperates with the College Extension Division in making selected courses available to adults who are not resident on the State College campus.

— — — — THE DEPARTMENT OF MODERN LANGUAGES

Professor Emeritus LAWRENCE E. HINKLE
Associate Professor GEORGE W. POLAND, *Head of the Department*
Associate Professor S. T. BALLENGER
Assistant Professors F. J. ALLRED, RUTH B. HALL, BERNARD S. MIKOFSKY

The Department of Modern Languages provides instruction in French, German, Spanish and Italian, as well as special instruction in English for foreign students. It also offers courses in the literature and culture of these language areas.

Courses in Russian are offered for graduate students only and, like the other language courses for graduate students, are directed solely toward achieving a reading knowledge.

The Department cooperates with graduate and research programs by offering special courses for graduate students in connection with language requirements for advanced degrees and by providing translation service. Graduate students enrolled in technical and scientificate courses translate projects in their field of major interest. Upon satisfactory completion of these projects, they are accepted as evidence of reading ability in the particular language. The translations are then made available to interested individuals or agencies.

— — — – DEPARTMENT OF PHILOSOPHY AND RELIGION

Professor W. N. HICKS, *Head of the Department*
Associate Professors PAUL A. BREDENBERG, J. LEONARD MIDDLETON
Assistant Professors W. CURTIS FITZGERALD, JR., W. LAWRENCE HIGHFILL

The primary function of the Department of Philosophy and Religion is to provide basic and fundamental courses in philosophy and religion especially designed to serve students in the several professional schools of the college—courses that are fundamental in the sense that the utility of critical analysis and the nature of faith are stressed and related to student experience. Since in matters religious and philosophical no universally acceptable final answers have been achieved, it is imperative that able and systematic and free examination of creedal beliefs and metaphysical assumptions in all areas be vigorously and unceasingly continued. Only in

this way can faith be kept vital, rigid provincialism thwarted and the significant intellectual achievements of the past and present conserved and advanced.

Personal challenge is extended to each student in all of the courses offered by the Department to live more fully in all of his relationships in terms of the high motives of love and reason, and to seek ultimate adjustment, not in passive conformity, but in duty freely accepted and unique creativity dared.

THE DEPARTMENT OF PHYSICAL EDUCATION

Professor PAUL H. DERR, *Head of the Department*
Professor Emeritus JOHN F. MILLER
Associate Professor WILLIAM E. SMITH
Assistant Professors J. B. EDWARDS, JR., HAROLD KEATING, JOHN F. KENFIELD, JR.
Instructors J. L. CLEMENTS, N. E. COOPER, H. O. FLOYD, JR., A. M. HOCH, W. R. LEONHARDT, J. H. LITTLE, FRANK J. MURRAY, W. M. SHEA, W. H. SONNER

The purpose of the Department of Physical Education is to make a maximum contribution to the general welfare of the student by providing programs and conditions in which he may develop and maintain physical strength and stamina, relax tensions, acquire an appreciation for the importance of healthful living and develop knowledge and skills for recreation. The programs also provide situations in which the student may develop qualities of cooperation, leadership and social poise.

To achieve these aims, the department serves two functions: it provides instruction and supervision for the participant in physical education in regular classes; and it offers opportunities for all students to participate in beneficial forms of physical exercise through the program in intramural athletics, which is administered by the department.

THE DEPARTMENT OF SOCIAL STUDIES

Professor GEORGE A. GULLETTE, *Head of the Department*
Professors C. I. FOSTER, A. K. F. MCKEAN
Associate Professors E. M. HALLIDAY, J. R. LAMBERT, JR
Assistant Professors R. N. ELLIOTT, ROBERT S. METZGER
Instructors J. L. COLE, W. F. EDWARES, R. W. HUERTLEY

The Department of Social Studies draws its staff from the various fields of the humanities and the social sciences. It contributes to the training of men whose professional competence is devoted to the public interest by offering courses especially designed to emphasize the close interconnections that bind liberal studies to the world of science and technology.

THE DEPARTMENT OF SOCIOLOGY AND ANTHROPOLOGY

Professor SANFORD R. WINSTON, *Head of the Department*
Associate Professors E. H. JOHNSON, H. D. RAWLS
Assistant Professor HERBERT COLLINS
Instructors J. L. COLE, W. F. EDWARES, R. W. HUERTLEY

Courses offered by the department fall into three overlapping areas: (1) courses concerned with the general education of the student; (2) supporting courses in those curricula in which a knowledge of society and

human behavior is deemed essential; and (3) courses given in conjunction with other departments which help prepare the student for rather specific types of professional activity upon graduation.

The general objective of courses in the department is to encourage the student as a citizen and as a professional person to see himself as a part of his society. It is believed that the student must understand something of the characteristics and functioning group behavior within the urban-industrial milieu of western civilization. He is shown that the human being operates within a social world which is the result of long cultural development, and he is encouraged to see his relationship within the framework of society with the result that he conceives of his behavior as a part of a larger social framework. The importance of adjustment to life is emphasized in all classroom teaching as well as in conferences on individual problems.

SCHOOL OF TEXTILES

MALCOLM E. CAMPBELL, DEAN
EDWARD A. MURRAY, DIRECTOR OF INSTRUCTION

INTRODUCTORY

Food, clothing and shelter are recognized as the three basic needs of man, and as a corollary of this fact the manufacture of textiles has become one of the world's leading industries. From early beginnings as an occupation governed by tradition and rule of thumb the textile industry has advanced to a highly complex, technical stage. North Carolina has risen steadily with the growth of textiles until it now ranks first in the nation in terms of employment and manufactured products. There are at present more than 900 textile plants located throughout the state producing a variety of commodities ranging from coarse cotton yarns and fabrics to the finest of laces and wearing apparel, from experimental synthetic fibers to finished fabrics woven of these man-made yarns. The current trend indicates that constant research and the application of its results are continuing to attract more manufacturers to the state along with even more diversified phases of the textile industry.

Because of the tremendous expansion in the scope of textiles it has become necessary to utilize the talents of the chemist, the physicist, the engineer, the businessman, as well as the traditional weaver, spinner and dyer. The field of textiles, although as old as man himself, has all the vigor

of a young industry; and because it encompasses such a diversity of activity, offers limitless opportunity to a man whatever his specific interest may be.

The School of Textiles offers technical instruction, both undergraduate and graduate, in the applied sciences underlying the production and finishing of textile products. Textile research, which is an important function in its operation, supplements and supports graduate study through applied and fundamental investigations.

The purpose of the School is fourfold: to educate men and women for professional service in all phases of the textile industry; to develop their capacities for intelligent leadership; to aid in the economic development of the textile industry; and to cooperate with the textile industry in improving, through scientific research, manufacturing efficiency and the quality and value of manufactured products.

For Administration, the School of Textiles is organized into five departments:

Professor E. B. GROVER	FIBER AND YARN TECHNOLOGY
Professor W. E. SHINN	KNITTING TECHNOLOGY
Professor B. L. WHITTIER	FABRIC DEVELOPMENT
Professor H. A. RUTHERFORD	TEXTILE CHEMISTRY
Professor W. A. NEWELL	TEXTILE RESEARCH

Curricula

Two four-year curricula, Textile Technology and Textile Chemistry, are offered. The freshman program is identical in each. Seven options in the Textile Technology curriculum enable a student to specialize in some particular phase of textiles. Each option includes 20 semester credits in related courses. The options, which are listed on page 159, are: General Textile Technology, Textile Management, Yarn Manufacture, Weaving and Designing, Knitting, Synthetics, Quality Control.

Selected courses leading to the degree of Bachelor of Science in Textiles are offered to graduates of universities and standard colleges. These are arranged in accordance with the professional aim of the student and the credits presented. If the student presents enough acceptable credits for courses required in a curriculum, he may be graduated with a Bachelor of Science degree in Textiles in one year. It should take no more than two years plus one or two summer schools to complete work for a degree.

A minimum of 160 semester credit hours is required for graduation.

Degrees

Upon the completion of any of the options in Textile Technology, the degree of Bachelor of Science in Textiles is conferred. Upon the completion of the curriculum in Textile Chemistry, the degree of Bachelor of Science in Textile Chemistry is conferred.

The degree of Master of Science in Textiles or of Master of Science in Textile Chemistry is offered for the satisfactory completion of one year of graduate study in residence. Candidates for the degree of Master of Science enter and are enrolled in the Graduate School of the College. For general requirements, consult The Graduate School Catalog.

FACILITIES

The Textile Building, erected in 1939 and greatly enlarged in 1950, was designed to harmonize teaching and laboratory facilities. It houses one of the most modern and best-equipped textile institutions in the world.

OPPORTUNITIES

Technological advances in textile fibers and manufacturing techniques have created a tremendous demand for men technically trained in textile colleges. For the past several years, the School of Textiles has had a demand for graduates greater than it could supply. Its graduates have entered the textile industry at salaries equal to or better than those offered in many other industries.

Graduates of the School are equipped to enter many fields related to textiles, such as manufacturing, sales or research; and alumni of the School hold responsible positions in each of these fields. Many are now mill presidents or general managers.

Some of the specific fields available are: production of yarns, production of woven and knitted fabrics, dyeing and finishing, industrial engineering, quality control, designing, styling, merchandising, converting, research, cost and production control sales of equipment and materials to the textile industry.

To assist in the placement of students and alumni and to facilitate interviews by textile firms, the School maintains a full-time Placement Director.

INSPECTION TRIPS

For certain of the textile courses offered, it is deemed advantageous for the student to see the manufacturing process under actual operating conditions. Therefore, when possible, trips are arranged for student groups to visit outstanding manufacturing plants. When so arranged, such trips are compulsory; transportation costs and other travel expenses, while held to a minimum insofar as possible, must be paid by the student.

SHORT COURSES

It is the policy of the School to offer short course training for textile mill men who have a limited amount of time to spend at the School. These courses can be offered when a demand for them exists. The subject matter is selected to meet the needs of the group.

EXTENSION COURSES

The staff of the School cooperates with the Extension Division of the College in offering textile courses by correspondence to employees of textile mills who wish to engage in this type of study. Applications for enrollment in these courses should be mailed direct to Edward W. Ruggles, Director, College Extension Division, State College Station, Raleigh, North Carolina.

FIBER AND YARN TECHNOLOGY

Professor ELLIOT B. GROVER, *Head of the Department*
Professor D. S. HAMBY
Associate Professors J. E. PARDUE, J. A. PORTER
Assistant Professor W. C. STUCKEY, JR.
Instructors BARBARA S. GAST, JAMES A. KING, L. T. LASSITER, R. E. WIGGINS

OBJECTIVES

The purpose of this Department is to instruct in the theory and practice of producing yarns; to conduct experimental processing in the utilization of cotton, wool, and the various synthetic fibers, and combinations of these; to study the engineering aspects of the machinery involved; and to cooperate with mills in solving manufacturing problems through research and experimentation.

FACILITIES

OPENING AND PICKING

The opening and picking equipment, located in a separate humidified laboratory, consists of two lines of equipment: a completely coordinated line consisting of blending feeders, openers and a one-process picker, arranged to allow full scale production with by-passes provided for man-made staple fibers and experimental work; and individual finisher picker for processing samples.

TEXTILES

CARDING SECTION

A laboratory equipped for carding, combing, drawing and related processes is located in one large humidified laboratory. The machinery consists of different types of cards, regular and controlled draft drawing, and combing machinery suitable for processing a wide range of materials from carded cotton to synthetics and wool on the cotton system.

ROVING SECTION

A complete group of roving frames, including conventional as well as controlled or long draft types is located in another laboratory.

YARN SECTION

The yarn section laboratory contains equipment for spinning, twisting and winding. In order to conserve room and to have as many types of equipment as possible, the machinery in this section has been built in shorter-than-standard lengths, but it is complete in every other respect. Practically all industrial types of drafting are represented, both in demonstration units and operating equipment. Sample installations are available of overhead cleaning, Pneumafil, roll buffing, different types of spindles and of many other modern developments. Included in the department also are several types of twisters and many of the standard types of winders to wind skeins, cones, dye packages, or tubes.

RESEARCH LABORATORIES

Three separate laboratories for applied research in fiber processing are located in the yarn department. These are described in the section under **Physical Testing Laboratories.**

CONTINUOUS FILAMENT LABORATORY

A laboratory completely equipped for the processing of continuous filament synthetic yarns from soaking through winding is enclosed in another separate humidified room. This laboratory has the complete range of equipment necessary for the processing of crepe, voile and hosiery yarn and includes: soaking tub, extractor, dryer, twist-setting oven, spooler, upstroke twisters, double twister, quill winder, cone winders, and nylon sizing machine, plus supplementary equipment.

WOOL SECTION

An entirely new laboratory has been set up for the processing of wool and long-staple synthetic fibers and blends. Included in the equipment is a Davis and Furber Wool Unit, complete from machinery to handle blending through the warping of the spun yarn. Another set of machinery in this laboratory is designed to process the longer staple natural and synthetic fibers on the American worsted system. Several tow-to-top machines, including a Pacific Converter and a Turbo-Stapler, are installed in this laboratory. Rectilinear combs and intersecting gills have also been provided.

PHYSICAL TESTING LABORATORIES

There are three separate air-conditioned laboratories, one of which is used for teaching and undergraduate student work and another for industrial research and graduate student research. The third laboratory, which has a separate air-conditioning unit, is used for fundamental and applied research where it is necessary to have atmospheric conditions varying from the standard.

The laboratories are equipped for the physical testing of fibers, yarns and fabrics. Included in the laboratory equipment are the following: a complete range of fiber testing equipment, three Instron Testers, several torsion and other types of balances, several combination skein and fabric breaking machines, inclined plane testers, single strand pendulum testers, Moscrop multiple single strand testers, bursting strength testers, drying ovens, abrasion machines, twist testers, densometers, hydrostatic pressure

tester, automatic reels, permeability testers, evenness testers and many other types of laboratory equipment, including both commercial and special instruments developed at the school.

MICROSCOPY

Excellent facilities are available for work in textile microscopy. The laboratory contains the most modern instruments including microscopes, cross sectioning devices and equipment for photomicrography. In addition to the ordinary monocular microscope, binocular and polarizing types are available. The dark room contains everything needed for photographic work.

The option in Yarn Manufacture is listed with the other options.

KNITTING TECHNOLOGY

Professor WILLIAM E. SHINN, *Head of the Department*
Associate Professor J. G. LEWIS
Assistant Professor H. M. MIDDLETON, JR.

OBJECTIVES

In recognition of the great importance of knitting and the other needle arts in the industrial life of this section, a Department of Knitting has been set up with the objective of making available to this branch of the textile industry personnel trained in the fundamentals and practices underlying the production of knitted textiles.

FACILITIES

The laboratories of the Knitting Technology Department, organized and equipped for instruction in many phases of the knit-goods industry, are grouped as follows:

SEAMLESS HOSIERY

Equipment for instruction in seamless hosiery production includes representative types of machines arranged in two groups. The more elementary types, including ribbers and plain hosiery machines with the elementary attachments such as stripers, reverse plating and rubber top attachments, are arranged together for beginning students. The more advanced types are grouped together for advanced students. This line includes advanced rib type machines, Komets, Banner Wrap Reverse, several types of float stitch machines. and machines for the manufacture of hosiery with ornamental wrap patterns.

NYLON HOSIERY

This section is equipped with three full-fashioned hosiery knitting machines of modern types, in 45-gauge, 51-gauge, and 54-gauge respectively. There is provided also a 400-needle women's nylon hosiery machine of the circular type. This equipment forms the basis for instruction in the general course in hosiery manufacture and for the more advanced instruction in full fashioned hosiery production. Equipment for the looping and seaming of hosiery, for preboarding, dyeing and finishing of fine hosiery is provided in separate rooms.

CIRCULAR KNITWEAR

A wide assortment of large diameter fabric knitting machines is provided for demonstration and instruction in the production of cloth for both underwear and outerwear. This group includes both latch needle and spring needle types for jersey, rib, interlock and Jacquard fabric.

GARMENT CUTTING AND SEAMING

A laboratory for experimental garment design and manufacture has been set up with modern power cutting equipment and many types of industrial sewing machines for producing garments for both outerwear and underwear. This unit is supplemented by knit goods finishing equipment located in the hosiery and knitwear finishing laboratory.

WARP KNITTING, FLAT KNITTING

The knitting department laboratories include five warp knitting machines of the tricot and raschel types. These machines furnish the basis for instruction in the design, analysis, and production of a wide range of warp knitted fabrics. A collection of fabrics and several winding and warp preparation machines make it possible to process a wide variety of materials. Flat machines of the V-bed and links-and-links type are employed for instruction in the production of heavier knitwear such as sweaters.

KNIT GOODS FINISHING

Devoted entirely to experimental work in hosiery and knit goods finishing, this laboratory contains modern equipment for pre-boarding, dyeing and finishing machinery, a knit goods calender for finishing knitted tubing, a fabric brush and an experimental warp sizing machine for the preparation of warp yarns for tricot knitting.

The option in Knitting Technology is listed with other options.

FABRIC DEVELOPMENT

Professor BENJAMIN L. WHITTIER, *Head of the Department*
Associate Professors J. B. GAITHER, W. E. MOSER
Assistant Professors E. B. BERRY, J. W. KLIBBE

OBJECTIVES

The purpose of this Department is to instruct students in the theory and practice of weaving and designing fabrics ranging from simple print cloths and elaborate leno and jacquard creations; to cooperate with the home economics departments of North Carolina colleges in creating consumer interest in textile products; to cooperate with mills in solving manufacturing problems through research and experimentation.

FACILITIES

WEAVING LABORATORIES

These laboratories contain a larger variety of looms than can be found in a textile mill, carefully selected so that the student may obtain knowledge of the different looms made in the United States. On this equipment are produced all types of fabrics, including print cloths, denims, sateens, ginghams, fancy shirting, dobby weave dress and drapery materials, pile, leno and jacquard fabrics, woven from natural and synthetic fibers. The weave room is completely humidified.

WARP PREPARATION

The equipment for preparing yarn for weaving is located in a separate department. This equipment includes a modern high speed warper and a rayon type slasher as well as auxiliary equipment such as skein, cone and filling winders. There is also a silk type combination warper and beamer used for making short warps for student instruction. There is a separate room for drawing in warps.

DESIGNING AND FABRIC ANALYSIS

Full design board equipment for both single and double cloths is provided in the classrooms. In addition to dies for cutting samples, different makes of balances and microscopes are provided for the analysis of fabrics. Other designing equipment includes an enlarging camera, mechanical design translators and card lacing equipment.

CLOTH INSPECTION

Separate facilities are provided where students can learn the technique of grading woven materials, using completely modern inspection equipment.

The option in Weaving and Designing is listed with the other options.

TEXTILE CHEMISTRY

Professor HENRY A. RUTHERFORD, *Head of the Department*
Professor K. S. CAMPBELL
Associate Professor A. C. HAYES

OBJECTIVES

The purpose of this Department is to instruct students in the chemistry of natural and synthetic fibers, and in the theory and practice of scouring, bleaching, dyeing, finishing and printing of yarns and fabrics; to conduct laboratory experimental work demonstrating the principles set forth in lecture periods; to cooperate with the mills of the state in solving problems relating to the wet processing of textile materials.

CURRICULUM

The curriculum in Textile Chemistry is listed with the other Textile curricula. Changes in the requirements for students selecting this curriculum may be anticipated from time to time in order that the academic training may be kept abreast of modern developments in the application of chemistry to textile materials.

FACILITIES

DYEING LABORATORY

This is a complete laboratory, modern in every respect, with generous provision for bench space, equipment storage facilities, utilities and steam baths. It is used for all laboratory work dealing with chemical properties of textiles, dye synthesis, color matching and all types of dyeing.

DYE HOUSE

In this room is assembled one of the finest groups of dyeing and finishing machinery for instructional and experimental purposes in existence anywhere. Obtained over the last three or four years at a cost of over $150,000, the equipment includes a singeing machine, a continuous dyeing range of the pad-steam type, a Williams unit, a du Pont-type continuous bleaching unit, four package dyeing machines, a dye beck, dye jig, rotary hosiery dyeing machine, piece goods dyeing and finishing units utilizing dry cans, enclosed tenter frame and a continuous loop drying and curing unit supplied with both steam and gas-fired heat sources.

RESEARCH AND TEXTILE CHEMICAL ANALYSIS

Two laboratories equipped for chemical research on fibers and on textile chemical specialties are available for use by advanced undergraduate students working on special problems and for research. Equipment includes a reflectometer, a spectrophotometer with all supplementary apparatus, colorimeters and the common testing equipment used for evaluation and for determining color-fastness, washfastness, etc., of dyed fibers and fabrics.

TEXTILE RESEARCH

Professor WILLIAM ANDREWS NEWELL, *Research Coordinator*
Professor J. F. BOGDAN, *Director of Processing Research*
Professor H. A. RUTHERFORD, *Director, Chemical Research*
Professor D. M. CATES, *Assistant Director, Chemical Research*

OBJECTIVES

Through financial assistance extended by the North Carolina Textile Foundation, a program of research has been initiated that is far-reaching in its influence on the operations and development of the textile industry

in North Carolina and in the nation.

The scope of this research embraces applied and fundamental investigations in the fields of fiber, yarns, fabrics, textile chemistry, fabrication, machinery.

Research is carried out by a full-time research staff, trained in the physical sciences, with the assistance of department heads and the members of the teaching staff.

FACILITIES

Equipment for processing and chemical research is available in eight laboratories, four of which are devoted entirely to research. In addition, equipment used for instruction can also be employed if needed. Complete spinning units are available for manufacture of yarns on the cotton, woolen and worsted systems.

The research department also carries out the training of students on both undergraduate and graduate levels by providing direct participation in the instructional program and by furnishing part-time employment to these students.

SYNTHETIC FIBERS DIVISION

OBJECTIVES

The purpose of this Division is to acquaint students with the various types of synthetic yarns and to instruct in the basic properties, handling methods and conversion into representative end products of each. The Division acts in conjunction with the Knitting, Technology, Fiber and Yarn Technology, Fabric Development, Textile Chemistry and Research Departments of the School of Textiles to provide a broad groundwork in synthetic yarn fundamentals.

FACILITIES

Laboratories are coordinated with and are a part of the laboratories of the Departments of Fiber and Yarn Technology, Fabric Development and Knitting Technology.

The option in Synthetics is listed with the other options.

MACHINE DESIGN AND DEVELOPMENT

C. M. ASBILL, JR., *Head of Department*

OBJECTIVES

The purposes of this department are:

To develop new types of textile machinery and to improve existing types.

To keep abreast of modern developments in machines and testing equipment by a digest of patents and technical articles in the various textile publications, as well as by close contacts with mills and machine manufacturers.

To furnish engineering assistance and advice relating to patents to individuals and organizations interested in the design or development of textile machines or related apparatus.

To place within reach of and at the disposal of interested students and the teaching and research staff of the School of Textiles the facilities of a qualified textile engineering department with means for the construction and testing of new and improved equipment.

FACILITIES

The facilities consist of design and drafting equipment together with a completely equipped machine shop for the production of both large production machines and smaller and more delicate testing apparatus.

The establishment of this Department within the School of Textiles was made possible by the financial assistance of the North Carolina Textile Foundation. Its functions extend to all phases of textile manufacturing and processing, including both the mechanical and electrical fields.

TEXTILE LIBRARY

KATHERINE MCDIARMID, *Librarian*

As a result of a substantial gift by the Burlington Mills Corporation, the Textile Library was relocated in the Textile Building in 1951. The new, enlarged quarters were designed to incorporate the latest functional improvements.

The library was organized in 1944; in 1945 the entire textile collection from the D. H. Hill Library was added to it. There are now about 7,000 volumes, of which 2,000 are bound periodicals. The library subscribes to 150 current periodicals, both American and foreign, which are thoroughly indexed in Industrial Arts Index, Chemical Abstracts, Natural and Synthetic Fibers and Textile Technology Digest.

In addition to books and periodicals, the librarian and student assistants maintain files of pamphlets, reprints, trade catalogs and patents. Special card indexes have been prepared for these collections.

The holdings of the Textile Library are available on loan not only to students and faculty of the College but also to research workers and industry employees throughout North Carolina.

CONSULTING SERVICE

GEORGE H. DUNLAP, *Textile Consultant*

In recognition of the need for close contact with the textile mills this division was organized with the assistance of the North Carolina Textile Foundation. It is the function of the Textile Consultant to visit as many mills as possible during the year, to discuss with executives their technical problems and assist in their solution. In many cases this involves experimental work which may be conducted in the mill or brought to the School for consultation with the staff or for special work in the laboratories.

The Textile Consultant frequently cooperates with the officials of trade associations in planning and arranging programs and represents the School at these meetings.

TEXTILE PLACEMENT BUREAU

GEORGE H. DUNLAP, *Director*

The Placement Bureau is a clearing house for students in the graduating class and for textile alumni. It is a coordinating agency for the employer and the graduates of the School of Textiles. The Placement Bureau tries to keep an accurate file of all textile alumni and the progress they have made. Therefore, all alumni are requested to notify the Director when they receive a promotion or transfer from one organization to another.

SPONSORED PROFESSORSHIPS

The School of Textiles has four sponsored professorships. These are made possible by funds contributed to the North Carolina Textile Foundation, Inc., and especially designated to pay a part of the annual salary of the Professor selected to fill the position.

The four professorships, together with the year of establishment and the name of the incumbent for each, are as follows:

TEXTILES

Burlington Industries Professorship of Textiles 1946.
DAME S. HAMBY, *Professor of Textiles, Department of Fiber and Yarn Technology*

Edgar and Emily Hesslein Professorship of Fabric Development 1948.
BENJAMIN LINCOLN WHITTIER, *Professor of Textiles and Head, Department of Fabric Department.*

Chester H. Roth Professorship of Knitting Technology 1948.
WILLIAM EDWARD SHINN, *Professor of Textiles and Head, Department of Knitting Technology.*

Abel C. Lineberger Professorship of Yarn Manufacturing 1948.
ELLIOTT BROWN GROVER, *Professor of Textiles and Head, Department of Fiber and Yarn Technology.*

CURRICULUM IN TEXTILE TECHNOLOGY

FOR ALL TEXTILE STUDENTS

			Credits	
1	CH 101	General Inorganic Chemistry	4	0
	CH 103	General and Qualitative Chemistry	0	4
	ENG 111, 112	Composition	3	3
	MA 111	Algebra and Trigonometry	4	0
	MA 112	Analytical Geometry and Calculus A	0	4
	ME 101	Engineering Graphics	2	0
	PS 201	The American Governmental System	0	3
	TX 101	Yarn Principles	2	0
	TX 151	Fabric Principles	0	2
	MS 101, 102 or*	Military Science I or		
	AS 121, 122	Air Science I	2	2
	PE 101, 102	Physical Education*	1	1
			18	19

FOR ALL EXCEPT TEXTILE CHEMISTRY STUDENTS

2	EC 201, 202	Economics	3	3
	HI 252	The United States Since 1865	3	0
	PY 211, 212	General Physics	4	4
	TX 201	Yarn Manufacture II	4	0
	TX 241	Knitting I	0	3
	TX 251	Cam Weaving	3	0
	TX 261	Fabric Structure	0	3
	TX 281	Fiber Quality	0	3
	TC 201	Textile Chemistry I	0	2
	MS 201, 202 or*	Military Science II or		
	AS 221, 222	Air Science II	2	2
	PE 201, 202	Physical Education*	1	1
			20	21

3	EC 401, 402 or PSY 200, 337	Principles of Accounting or Introduction to Psychology; Industrial Psychology I or		
	MA 211, 212	Analytic Geometry and Calculus B, C	3	3
	TC 301, 302	Textile Chemistry II	3	3
		English**	3	3
	TX 301	Yarn Manufacture III	0	4
	TX 323	Textile Testing II	3	0

TX 341	Hosiery Manufacture	2	0
TX 351	Dobby Weaving	3	0
TX 361	Dobby Design	0	3
	Electives	4	4
		21	20

4

EC 425	Industrial Management	3	0
EC 426	Personnel Management	0	3
TX 483	Textile Cost Methods***	2	0
TX 484	Mill Organization	0	3
TX 581	Instrumentation and Control	3	0
TX 425	Textile Microscopy	0	1
	Selected Option: (20 credits in General Textiles, Textile Management, Yarn Manufacturing, Weaving and Designing, Knitting Technology, Synthetics or Quality Control) See Options	10	10
	Electives	3	3
		21	20

* Students excused from Military or Air Science and/or Physical Education will schedule equivalent credits in courses from the following departments: Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Psychology, Rural Sociology, Social Studies, or Sociology.

** If approved in advance by the Director of Instruction, students who average C or above on Composition, Eng. 111, 112, may substitute 6 credits of Modern Language.

*** Students in Management Option will substitute an approved textile course.

OPTIONS

GENERAL TEXTILES OPTION

TX 401	Yarn Manufacture IV	4	0
TX 411	Wool Manufacture	0	3
TX 431	Synthetics I	2	0
TX 451	Weaving Laboratory	1	0
TX 461	Design IV	3	0
TX 472	Fabric Analytics	0	2
	Textile Courses****	0	5
		10	10

TEXTILE MANAGEMENT

EC 411, 412	Marketing Methods and Sales Management	3	3
EC 504, 505	Principles of Cost Accounting	3	3
	Textile Courses****	4	4
		10	10

YARN MANUFACTURE

TX 401	Yarn Manufacture IV	4	0
TX 402	Mill Technology	0	3
TX 411	Wool Manufacture I	0	3
TX 431	Synthetics I	2	0
TX 435	Synthetic Fiber Processing	0	4
	Textile Courses****	4	0
		10	10

**** MA 211, 212 may be substituted for elective courses.

TEXTILES

WEAVING AND DESIGNING

		Credits	
TX 431	Synthetics I	2	0
TX 451	Weaving Laboratory	1	0
TX 452	Weaving Technology	0	2
TX 461	Design IV	3	0
TX 472	Fabric Analytics	2	0
TX 561	Special Weave Formations	0	2
TX 562	Jacquard Design and Weaving	0	3
	Textile Courses****	2	3
		10	10

KNITTING TECHNOLOGY OPTION

TX 343	Knitted Fabric Design and Analysis	2	0
TX 441	Flat Knitting	3	0
TX 443	Knitting Mechanics	3	0
TX 444	Garment Manufacture	0	3
TX 445	Full Fashioned Hosiery Manufacture	0	2
TX 447, 448	Knitting Laboratory II	2	2
TX 449	Tricot Knitting	0	3
		10	10

SYNTHETICS OPTION

TX 402	Mill Technology	0	3
TX 433	Synthetics II	4	0
TX 435	Synthetic Fiber Processing	0	4
TX 476	Synthetics III	0	3
TC 421	Fabric Finishing I	2	0
	Textile Courses****	4	0
		10	10

QUALITY CONTROL OPTION

ST 361	Introduction to Statistics for Engineers	3	0
TX 424	Development Project	0	2
TX 521	Testing and Quality Control	4	0
TX 522	Textile Testing III	0	4
	Textile Courses****	3	4
		10	10

**** MA 211, 212 may be substituted for elective courses.

CURRICULUM IN TEXTILE CHEMISTRY — — — — — — — — — —

The freshman year is the same as for the Textile Curriculum

			Credits	
2	CH 211, 212	Quantitative Analysis	4	4
	HI 252	The United States Since 1865	3	0
	MA 211, 212	Calculus	3	3
	PY 211, 212	General Physics	4	4
		English Elective	0	3
	TX 261	Fabric Structure	0	3
	TX 284	Textile Processing	3	0
	MS 201, 202*	Military Science		
	or	or		
	AS 221, 222	Air Science	2	2
	PE 201, 202	Physical Education	1	1
			20	20

			Credits	
3	CH 421, 422	Organic Chemistry	5	5
	EC 201, 202	General Economics	3	3
		English Elective	0	3
	TC 303, 304	Textile Chemistry III	4	4
	TX 321	Textile Testing I	3	0
	TX 425	Textile Microscopy	0	1
		Electives	3	3
			18	19
4	EC 425	Industrial Management	3	0
	EC 426	Personnel Management	0	3
	TC 403, 404	Textile Chemistry IV	4	4
	TC 423	Fabric Finishing II	3	0
	TC 431	Textile Printing	0	3
	TC 511, 512	Chemistry of Fibers	2	2
	TX 581	Instrumentation and Control	3	0
		Physical Science, Mathematics or Textile Courses	3	3
		Electives	3	3
			21	18

* Students excused from Military or Air Science and/or Physical Education will schedule equivalent credits in courses from the following departments: Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Psychology, Rural Sociology, Social Studies, or Sociology.

THE GRADUATE SCHOOL
NORTH CAROLINA STATE COLLEGE

WILLIAM M. WHYBURN, *Vice-President, Graduate Studies and Research, Chapel Hill*

JAMES S. BETHEL, *Acting Dean, Raleigh*

The Graduate School of the Consolidated University of North Carolina is composed of three divisions, one at each of the three units of the University System. Each unit is administered by a Graduate Dean and an Administrative Board representing the various degree-granting areas in each institution. The Vice-President for Graduate Studies and Research is the administrative officer of the Consolidated University who has responsibility for the development of policy in all graduate programs and for the coordination of the activities of the graduate schools at each of the three units of the University System.

At State College, graduate instruction is offered in the fields of Agriculture, Engineering, Forestry, Technological Education and Textiles. The degree of Master of Science is offered in each of these areas. The Professional Master's Degree also offered in some of these fields is intended for students who are interested in the more advanced applications of fundamental principles to specialized fields rather than in the acquisition of

the broader background in advanced scientific studies which would fit them for careers in research.

The degree of Doctor of Philosophy is offered in the following fields of study:

Agricultural Economics
Agricultural Engineering
Animal Industry
Botany (in the fields of physiology and ecology)
Ceramic Engineering
Chemical Engineering
Civil Engineering
Electrical Engineering
Engineering Physics
Entomology
Experimental Statistics
Field Crops
Forestry
Genetics
Nuclear Engineering
Plant Pathology
Rural Sociology
Soils
Zoology (in the fields of ecology and wildlife management)

Students interested in graduate study should consult the Graduate School catalog. A copy will be sent upon request. Inquiries should be addressed to:

Dean, GRADUATE SCHOOL, North Carolina State College, Raleigh, North Carolina.

COLLEGE EXTENSION DIVISION

EDWARD W. RUGGLES, *Director*

OBJECTIVES

The College Extension Division is organized to carry the practical and cultural advantages of college studies to persons who cannot attend classes on the campus, and to groups and communities which may profit by the services offered.

SERVICES

Extension courses are organized where at least fifteen persons are interested and are willing to take up the same subject. In setting up the courses, such matters as distance from the college, nature of the subject, and availability of instructors must be taken into consideration.

Correspondence courses for college credit are offered in agriculture, architecture, economics, education, engineering, English, geology, history, political science, mathematics, modern languages, psychology, rural sociology, sociology, statistics and textiles. This listing of more than 75 courses continues to grow.

The Correspondence Bureau has also set up a program of four high school courses—English review, review of elementary algebra, solid geometry and plane geometry. The purpose of these non-credit courses is to give high school graduates an opportunity to fulfill the college entrance requirements and also to assist those who make low scores on their entrance examinations.

Another course, Building and Estimating, is offered through the Correspondence Bureau but does not carry college credit. It is designed to stress practical application of the subject matter. Other correspondence courses may be taken for professional credit rather than college credit.

The night class program is another Extension Division service. Each fall and each spring, a series of credit, hobby and vocational classes is presented on the college campus for residents of the Raleigh area. Similar courses are also taken to various communities where the demand is sufficiently great and others are conducted at military bases in the State.

A new night program has been added. The Extension Division conducts a series of classes in sub-freshman mathematics on the college campus.

A wide variety of short courses and conferences is planned each year by the Extension Division in cooperation with several Schools at State College.

Some of these specialized courses, increasing in popularity, include those for electrical meter engineers, veterinarians, surveyors, apple and peach growers, gas plant operators, dry kiln operators, sawmill operators, seedsmen, pest control operators, clay plant operators, nurserymen, freezer plant operators, cemetery superintendents, artificial breeders, farm managers and many others.

Among the others offered annually are the beef cattle conference, dairymen's conference, statistical quality control, furniture finishing, grain marketing, farm and small business income tax, sport fishing, water works school, industrial waste conference, swine conference, personnel testing institute, industrial management, industrial safety, motion and time study, job evaluation, introduction to quality control, industrial relations, pesticide school, cotton classing, lumber grading, parks and recreation workshop, aerial photo interpretation, commercial flower growers, linear programming, warm air heating and air conditioning, beef production, state garden schools, dairy production, dairy manufacturing, field crops production, dairy herd testing, radio, nutrition school, advertising, oil burner schools, retail building supply marketing institute, textile conferences, quality concrete conference, poultry processors, personnel testing institute—introductory and advanced interviewing and counseling, management psychology, and personnel research, N. C. Press mechanical conference, short course in modern farming, industry research conference, brick and tile institute, safety school, nuclear engineering courses, and scores of others to benefit trade and professional groups.

The Gaston Technical Institute is conducted by the Extension Division as a division of the college's School of Engineering. Gaston Tech, located in Gastonia, offers four two-year technical training courses in electrical, civil, electronics and mechanical-production technology. A separate catalog on the school and its curricula is available upon request.

The North Carolina Truck Driver Training School conducts twelve four-week training courses for professional truck drivers each year. These schools are sponsored by the N. C. Motor Carriers Association. A bulletin giving complete details and application forms is available.

For additional information, persons interested in extension classes, correspondence courses or any of the other programs sponsored by the Extension Division should write Edward W. Ruggles, Division of College Extension, North Carolina State College, Raleigh, North Carolina.

MILITARY TRAINING

— — DEPARTMENT OF MILITARY SCIENCE AND TACTICS

Professor of Military Science and Tactics COL. L. W. MERRIAM
Assistant Professors of Military Science and Tactics LT. COL. HENRY J. PIERCE, MAJOR VERNON B. DRUM, MAJOR DONALD J. MCGURK, MAJOR EDWIN M. REID, MAJOR TYRUS R. SPINELLA, MAJOR ROBERT A. TOLAR, CAPT. RUTH M. ISHAM, CAPT. JOHN W. MCDANIEL, JR., AND CAPT. PURDY B. MCLEOD, JR.

DEPARTMENT OF AIR SCIENCE — — — — — — — —

Professor of Air Science COL. ROBERT C. PAUL
Assistant Professors of Air Science MAJOR FRANK S. COVEY, MAJOR HILLIARD B. MCCULLOUGH, CAPT. MICHAEL E. ALVARADO, CAPT. RICHARD L. CARROLL, CAPT. JOHN B. FINK, CAPT. QUENTIN M. LEWIS, CAPT. KENDALL G. LORCH

OBJECTIVES — — — — — — — — — — — — —

The Reserve Officers' Training Corps (ROTC) at State College designates those students enrolled for training in the Department of Military Science and Tactics or in the Department of Air Science. These Departments are integral academic and administrative subdivisions of the institution. The senior Army officer and the senior Air Force officer assigned to the College are designated as Professor of Military Science and Tactics (PMST) and Professor of Air Science (PAS), respectively. These senior officers are responsible to the Secretary of the Army, the Secretary of the Air Force, and the Chancellor of the College for conducting their training and academic program in accordance with instructions issued by the respective secretaries and as required by college regulations. Army officers who are assigned to the College as instructors in ROTC are designated as Assistant Professors of Military Science and Tactics; Air Force officers, as Assistant Professors of Air Science. Non-commissioned officers of the Army are assigned as assistant instructors and administrative personnel. Non-commissioned officers of the Air Force are assigned as administrative and supply personnel.

The Army ROTC, in four years of military training, produces junior officers who have the qualities and attributes essential to their progressive and continued development as officers of the United States Army.

The mission of the Air Force ROTC, as defined by the Department of the Air Force, is to select and prepare students, through a permanent program of instruction at civilian educational institutions, to serve as officers in the regular and reserve components of the United States Air Force and to assist in discharging, where necessary, any institutional obligations to offer instruction in military training.

COURSES OF INSTRUCTION — — — — — — — — — —

Programs of instruction for both Army and Air Force ROTC consist of a two-year basic course and a two-year advanced course. The satisfactory completion of the basic course in either the Army or Air Force ROTC is required for all physically fit male freshmen and sophomores unless they are excused by the College Administration.* The College provides, in cooperation with the Air Force and the Army, a flight instruction program. A limited number of highly qualified cadets from both ROTC units participate in this instruction, approximately 35 hours of flying in light aircraft plus ground school. Successful completion of this phase of the ROTC course qualifies the cadet for a Civil Aeronautics Administration approved private pilot's license. A detailed description of all military courses is given under each of the departments in the section of the Catalog which lists Course Descriptions.

MILITARY SCIENCE AND TACTICS — — — — — — — — -

The satisfactory completion of the first year of the Army ROTC course is a prerequisite to entering the second year. Enrollment in advanced courses is elective on the part of the student. The selection of advanced course stu-

* All veterans in active service as long as six months are excused from this requirement, but may enroll in the basic course of Army or Air Force to qualify for later enrollment in advanced courses.

dents is made from applicants who are physically qualified and who have above average academic and military records. Veterans who have one year or more of service in the Armed Forces are eligible for enrollment in the Army ROTC Advanced Course upon reaching their junior year, provided they are in good academic standing, physically qualified, have not reached their 27th birthday and are selected by the PMST and the Chancellor.

The Army ROTC course includes instruction in American Military History, Map Reading, Leadership, Military Teaching Methods, Military Administration, Operations and Logistics. These subjects not only prepare students to be officers in the United States Army, but also awaken in them an appreciation of the obligations of citizenship and secure for them personal benefits resulting from practical application of organization and responsible leadership.

AIR SCIENCE

Enrollment in the Air Force ROTC advanced course is elective on the part of the student. Selection of advanced course students is made from applicants who are physically qualified and who have above average academic and military records. Qualified veterans desiring a commission through the AFROTC will be required to take that portion of the basic course, with their non-veteran contemporaries, which remains before they are classified as academic juniors. All veterans must have completed their academic and military requirements prior to their 28th birthday.

The Air Force ROTC course of study includes instruction in Global Geography, International Tensions and Security Organizations, Instruments of National Military Security, Problem Solving Techniques, Principles of Leadership and Management, and Applied Air Science in addition to other applicable subjects. The Air Force ROTC curriculum is designed to prepare the student for his obligations of citizenship to his country both as an officer in the United States Air Force and as a civilian.

UNIFORMS AND EQUIPMENT

Officer's type uniforms for students enrolled in both basic and advanced courses in Army ROTC are provided by the Federal Government. Students enrolled in the basic course in Air Force ROTC are provided Air Force type uniforms; for students enrolled in advanced courses in both Army and Air Force ROTC the college is furnished a monetary allowance by the Federal Government for the purchase of uniforms. Army and Air Force equipment for instruction of students is provided by the Federal Government. Both uniforms and equipment are issued to the College, which is accountable for their care and use.

CREDIT

Credit is allowed for work at other institutions having an ROTC Unit established in accordance with the provisions of the National Defense Act and regulations governing the ROTC. Record of a student's prior training in the ROTC is obtained from the institution concerned.

FINANCIAL AID

Students enrolled in the advanced course are paid a monetary allowance in lieu of subsistence at the daily rate equal to the value of the commuted ration ($0.90) for a total period not to exceed 595 days during the two years of the course. Students in the basic course receive no monetary allowance.

ORGANIZATION OF THE ROTC

ARMY

The Army ROTC Unit at State College consists of an Army regiment and a Drum and Bugle Corps. The Army regiment, commanded by a cadet colonel and staff, consists of a Headquarters Company and three battalions.

MILITARY TRAINING

The cadet colonel and all other cadet officers are selected from students enrolled in the second year advanced course. Cadet 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 are also appointed as cadet non-commissioned officers. Cadet officers and non-commissioned officers obtain invaluable experience in leadership by being responsible for conducting all drill instruction. They are observed and supervised in this by the officers and non-commissioned officers of the Army assigned to the College.

AIR FORCE

The Air Force ROTC unit consists of an Air Force Wing and a Drill Team. The Air Force ROTC Wing, commanded by a cadet colonel, consists of three groups, which are composed of four squadrons each. These squadrons are divided into three flights per squadron, each flight consisting of three squads. The wing, group, squadron, and flight commander and their staffs are cadet commissioned officers, and are selected from cadets enrolled in the second year advanced course. All other positions are held by cadet non-commissioned officers, who are selected from the first year advanced and second year basic cadets. Cadet officers and non-commissioned officers obtain invaluable experience in leadership by being responsible for planning and conducting all drill instruction. They are observed and supervised by the officers and airmen assigned to the College.

DISTINGUISHED MILITARY STUDENTS

The College is authorized to designate outstanding students of the ROTC and AFROTC as Distinguished Military Students. These Students may, upon graduation, be designated Distinguished Military Graduates and may be selected for commissions in the regular Army or Air Force, provided they so desire.

SELECTIVE SERVICE IN RELATION TO THE ROTC

Enrollment in the ROTC does not in itself defer a student from induction and service under the Universal Military Training and Service Act. The law provides that "within such numbers as may be prescribed by the Secretary of Defense, any person who (A) has been or may hereafter be selected for enrollment or continuance in the senior division, Reserve Officers' Training Corps, or the Air Force Reserve Officers' Training Corps, or the Naval Reserve Officers' Training Corps; (B) agrees, in writing, to accept a commission, if tendered, and to serve, subject to order of the Secretary of the Military Department having jurisdiction over him, not less than two years on active duty after receipt of a commission; and (C) agrees to remain a member of a regular or reserve component until the eighth anniversary of the receipt of a commission in accordance with his obligation under subsection (D) of section 4 of this title, shall be deferred from induction under this title after completion or termination of the course of instruction and so long as he continues in a regular or reserve status upon being commissioned, but shall not be exempt from registration."

We have magnified results rather than methods of instruction, the use of knowledge rather than its mere acquisition, and the value of our students (alumni) to themselves and to our State rather than the cost of the college's equipment and the greatness of its faculty.

Wallace Carl Riddick
President, 1916-1923

Our aim shall be to combine more completely our natural and human resources, to improve and simplify the machinery of life, and especially to discover and magnify the elements of worth in our students and stimulate a genuine passion for right living. Such a high aim realized will give a greater commonwealth and make certain a greater State College.

Eugene Clyde Brooks
President, 1923-1934


RIDDICK
PIONEERING LABORATORIES

RIDDICK ENGINEERING
LABORATORIES

IV. DESCRIPTIONS OF COURSES

Alphabetically	Pages
A through B	170-182
C through D	182-197
E through F	197-220
G through H	220-229
I through L	229-240
M through O	241-256
P through R	256-271
S through Z	272-288

AGRICULTURAL ECONOMICS

COURSES FOR UNDERGRADUATES

Credits and Terms Offered

AGC 212 ECONOMICS OF AGRICULTURE **3 (3-0) f s**
Prerequisite: EC 201
An introduction to the economic principles underlying agricultural production; production organization in agriculture; consumers and their influence on the demand for agricultural products; the relationship between agriculture and the rest of the economy; dynamic factors in the economy as they affect agriculture.

Staff

AGC 303 FARM MANAGEMENT I **3 (2-2) f s**
Prerequisite: AGC 212
This course is designed to help students understand how basic economic principles and techniques of analysis can be applied in the successful operation of a farm business. Practice in planning the organization and operation of a farm, including an economic evaluation of alternatives is emphasized. Special attention is given to problems of mechanization, leasing arrangements, credit financing and labor management. Also, training in the use of farms records as an aid to better business management and in planning adjustments is provided.

Mr. Pierce

AGC 311 MARKETING AGRICULTURAL PRODUCTS **3 (2-3) f s**
Prerequisite: AGC 212
The objective of this course is to provide the student with a better understanding of the marketing system. Emphasis is placed on the role of the marketing firm in providing efficient marketing services, including a discussion of techniques for making management decisions. Public policies directed toward greater marketing efficiency are examined. Principles of marketing are supplemented with problems dealing with the reorganization of marketing firms, and with visits to firms marketing agricultural products.

Mr. Stemberger

AGC 322 ORGANIZATION AND MANAGEMENT OF COOPERATIVES **2 (2-0) s**
Prerequisite: AGC 212
A study of the principles of cooperation applied to farmers' purchasing, marketing, and service cooperatives; the role of cooperatives in our society, and problems associated with organization, operation and management.

Mr. King

AGC 342 MARKETING FIELD CROPS **3 (2-3) f**
Prerequisite: AGC 212
The marketing of cotton, tobacco and grain is studied by examining the management decisions made by the agricultural businesses marketing them. Particular attention is given to the processes by which decisions are made, to the effects of demand and supply conditions upon marketing and to the nature of the various influences affecting the prices of these commodities.

Staff

AGC 362 MARKETING DAIRY PRODUCTS **3 (3-0) f**
Prerequisite: AGC 212
Economic problems in marketing milk including management decisions concerning location, size and nature of processing plants; organization of assembly and delivery routes; bargaining and pricing schemes; analysis of consumer demand and govermnent regulation of milk and milk products.

Staff

AGC 364 MARKETING FRUITS AND VEGETABLES **3 (2-3) s**
Prerequisite: AGC 212
Introduction to marketing with illustrations and particular application to fruits and vegetables; buying and selling decisions faced by farmers; supply and demand characteristics of principal fruits and vegetables; the organization of markets and methods of marketing; pricing and price discrimination; relation of the processing industry to firms marketing fresh products; and the role of government in establishing grades and standards, provision of inspection services and establishment of marketing orders and agreements.

Mr. King

AGC 372 MARKETING LIVESTOCK **3 (3-0) s**
Prerequisite: AGC 212
This course is concerned with the livestock marketing industry. It is a study of the businesses which handle livestock and meats from their production to the consumer. These businesses include farmers, local auction market and buying station operations, meat packers and retail meat markets. Each type of business operation is studied with the idea of determining the major economic problems which they face, the sources of these problems and the manner in which they may best be solved.

Mr. Williamson

COURSES FOR ADVANCED UNDERGRADUATES

AGC 413 FARM APPRAISAL AND FINANCE **3 (2-3) s**
Prerequisite: AGC 303
The principles of farm appraisal and practical methods used in determining the value of farms of various types and sizes; credit financing in agriculture, including (1) types, sources, and cost of credit, (2) repayment plans, (3) methods of determining when and how credit can be used effectively by farmers; special problems associated with agricultural credit.
Mr. Lindsey

AGC 431 INTRODUCTION TO AGRICULTURAL PRICES **3 (3-0) f**
Prerequisite: AGC 212
This course involves an examination of the behavior of agricultural prices as related to decision making of economic units. Emphasis will be placed upon the role of prices in the economy; the behavior of agricultural prices; the relation of prices to income, consumption and production of farm products; marketing practices which influence price formation in the exchange of agricultural products. Attention also will be given to methods of agricultural price analysis.
Mr. Pierce

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

AGC 501 INTERMEDIATE AGRICULTURAL ECONOMIC THEORY **3 (3-0) f s**
Prerequisite: AGC 212, or equivalent
This course will deal with the functions of an economic system; theories of demand and utility; costs and production; competitive and monopolistic pricing; income distribution. (Advanced students outside Agricultural Economics may use this course to prepare for specialized graduate courses in Agricultural Economics, Econometrics, or Economics.)
Staff

AGC 512 LAND ECONOMICS **3 (3-0) f**
Prerequisite: AGC 212, or equivalent
The significance of land as a factor of production in the modern market economy; land resources, their use, and the conservation problem in the United States; the institutional setting: tenure, tenancy and the family farm in the United States and other countries; land policies: background and problems in Western countries and in underdeveloped areas of the world.
Staff

AGC 521 ECONOMICS OF AGRICULTURAL MARKETING **3 (3-0) s**
Prerequisite: AGC 311, or equivalent
A study of marketing firms as producers of marketing services and their role in the pricing process; the influence of government policies on the behavior of marketing firms; methods for increasing the efficiency of marketing agricultural products.
Mr. King

AGC 523 FARM MANAGEMENT II **3 (2-2) f**
Prerequisite: AGC 303, or equivalent
Study of the techniques in formulating and solving problems on characteristic farms in the state; decision-making principles as tools for assisting managers in appraising alternative solutions to problems of farm organization and methods of production; analysis of the functions of management including evaluation of resource adjustments that arise because of incomplete information and changing conditions; the development of county and area farm management programs.
Mr. Coutu

AGC 533 AGRICULTURAL POLICY **3 (3-0) s**
Prerequisite: AGC 212
This course is concerned with the farmer and his relationship to government. It is a study of past, present and potential governmental policies, their effects upon farmers and farm families, and upon the contribution which farmers make to material progress and social welfare. Among the governmental policy topics studied ar eproduction controls, price supports, storage operations, land conservation, research and education and international trade.
Mr. Williamson

AGC 551 AGRICULTURAL PRODUCTION ECONOMICS **3 (3-0) f**
Prerequisite: AGC 212
An introduction to some of the tools that are applicable to an economic analysis of agricultural production, including: production functions, cost functions, programming and decision making principles; and the applications of these principles to farm and regional resource allocation, and to the distribution of income to and within agriculture.
Mr. Toussaint

AGRICULTURAL ECONOMICS

AGC 552 CONSUMPTION, DISTRIBUTION AND PRICES IN AGRICULTURE **3 (3-0) s**
Prerequisite: AGC 212
Basis for family decisions concerning consumption of goods and services and supply of owned factors of production; relation of decisions of the household to demand and supply in the aggregate; forces determining the incomes of households with particular attention to lessening of competition; uncertainty and economic growth in relation to household decisions and family incomes; introduction to related empirical studies.

Mr. Henry

AGC 561 SEMINAR IN CONTEMPORARY AGRICULTURAL PROBLEMS **Maximum of 6**
Prerequisite: Senior or graduate standing and consent of instructor
Analysis of economic problems of current interest in agriculture. Credit for this course will involve a scientific appraisal of a selected problem and alternative solutions.

Staff

COURSES FOR GRADUATES ONLY

AGC 602 MONETARY AND FISCAL POLICIES IN RELATION TO AGRICULTURE **3 (3-0) s**
Prerequisite or corequisite: AGC 501, or equivalent
The essentials of monetary theory necessary in interpreting and evaluating monetary and fiscal operations and policies as to their effect upon income, employment and price level; the monetary and fiscal structure and the mechanics of monetary and fiscal operations in the United States; and the relation of monetary and fiscal policies to agricultural income and prices.

Messrs. Tolley, Williamson

AGC 611 WAGE, PRICE AND PRODUCTION POLICIES IN RELATION TO AGRICULTURE **3 (3-0) s**
Prerequisite: AGC 602
Theories of wages and employment, collective bargaining and wage differentials; industrial organization in the economy; integration, price and production policies, costs and prices in the cycle, and government policies and workable competition; direct and indirect effects of labor and monopoly policies upon the employment of resources, national income and its distribution, price levels, wages, interest rates and upon economic magnitudes in agriculture.

Mr. Lindsey

AGC 612 INTERNATIONAL TRADE IN RELATION TO AGRICULTURE **3 (3-0) s**
Prerequisite or corequisite: AGC 602 and 641
The principles of international and interregional trade; structures of trade relationships between countries engaged in the import or export of agricultural products; attempts at stabilizing trade and financial transactions.

Mr. Tolley

AGC 621 RESEARCH IN AGRICULTURAL ECONOMICS **Credits by arrangement**
Prerequisite: Graduate standing in Agricultural Economics and consent of Graduate Advisory Committee
A consideration of research methods and procedures employed in the field of agricultural economics, including qualitative and quantitative analysis, inductive and deductive methods of research procedure, selection of projects, planning and execution of the research project.

Graduate Staff

AGC 631 ECONOMIC AND SOCIAL FOUNDATIONS OF AGRICULTURAL POLICY **3 (3-0) f**
Prerequisite: AGC 501, or equivalent
The study of logical and empirical problems of inquiry into public policies and programs that affect agriculture; analysis of policy-making processes, interdependencies among economic, political and social objectives and action; the study of forces which shape economic institutions and goals and of the logic, beliefs and values on which policies and programs that affect agriculture are founded.

Mr. McPherson

AGC 632 WELFARE EFFECTS OF AGRICULTURAL POLICES AND PROGRAMS **3 (3-0) f**
Prerequisite: AGC 642
Descriptions of the conditions defining optimal resource allocation; application of the conditions for maximum welfare in appraisal of economic policies and programs affecting resource allocation, income distribution and economic development of agriculture.

Mr. Bishop

AGC 641 ECONOMICS OF PRODUCTION, SUPPLY AND MARKET INTERDEPENDENCY **3 (3-0) f s**
Prerequisite: AGC 501, or equivalent
An advanced study in the logic of, and empirical inquiry into: producer behavior and choice among combinations of factors and kinds and quantities of output; aggregative consequences of individuals' and firms' decisions in terms of product supply and factor demand; factor markets and income distribution; general interdependency among economic variables of any economy.

Messrs. Seagraves, Williamson

AGC 642 ECONOMICS OF CONSUMPTION, DEMAND AND MARKET INTERDEPENDENCY **3 (3-0) s**
Prerequisite: AGC 641 and ST 513, or equivalent
An advanced study in the theory of, and research into, household behavior; aggregative consequences of household decisions concerning factor supply and product demand; pricing and income distribution; economic equilibrium.

Mr. King

AGC 651 (ST 651) ECONOMETRIC METHODS I **3 (3-0) s**
Prerequisite: ST 514, 521 and AGC 642
Decision making under uncertainty; stochastic elements in economic theories; problems of model construction; special techniques for analyzing simultaneous economic relations.

Graduate Staff

AGC 652 (ST 652) ECONOMETRIC METHODS II **3 (3-0) f**
Prerequisite: ST 513, 522 and AGC 641
Basic concepts of estimation and tests of significance as applied to economic data; empirical sampling methods; non-parametric methods; sequential testing; extension of least squares methods to research in economics; production surfaces; special topics in variance components and mixed models; use of experimental designs in economic research; elements of multivariate analysis; techniques for analysis of time series.

Mr. Anderson

AGC 671 ANALYSIS OF ECONOMIC DEVELOPMENT IN AGRICULTURE **3 (3-0) f**
Prerequisite: AGC 642
A theoretical framework for analysis of the causal forces and the structural interdependencies under conditions of economic change; major problems likely to be encountered in empirical endeavor.

Mr. Maddox

AGRICULTURAL EDUCATION

COURSES FOR UNDERGRADUATES

ED 101 INTRODUCTION TO AGRICULTURAL EDUCATION **1 (1-0) f**
A study of the job ahead, in college and as a teacher of vocational agriculture; present program in North Carolina.

ED 102 OBJECTIVES IN VOCATIONAL AGRICULTURE **1 (1-0) s**
Purpose of vocational agriculture in the school program. Relation of objectives and evaluation. Financing vocational agriculture. Emphasis on the local school community as a setting for a program of vocational agriculture. Advantages of being a part of the public school.

ED 201 FFA IN VOCATIONAL AGRICULTURE **1 (1-0) s**
Purposes of Future Farmers of America (FFA) in vocational agriculture, Relationship of FFA to supervised farming program. Developing leadership through FFA.

ED 313 ORGANIZING PROGRAMS OF VOCATIONAL AGRICULTURE **3 (3-0) s**
Essentials of an effective program of vocational agriculture. Developing the program in the local community. Role of the teacher in developing the local program.

ED 411 STUDENT TEACHING IN AGRICULTURE **6 (3-12) f**
The first seven weeks will be on campus; thereafter in selected schools. These schools will be selected and assigned, then visited by the students. Using the program in his selected school as a guide, the student will study methods of teaching vocational agriculture, including techniques of teaching, selecting and using reference materials, supplies, equipment and visual aids; organizing and conducting farming programs, FFA adult and young farmer classes and other phases of the vocational agriculture program. The student will plan effectively for student teaching in his selected school.
For the remainder of the semester, the student lives in his selected community. He takes part, and gets experience, in all phases of the vocational agriculture program. His student teaching is supervised by members of the staff in Agricultural Education and the local vocational agriculture teacher.

NOTE: 1. A student must have a "C" average at the time he registers for this course.
2. **Summer Practice**—During the summer prior to the year in which students register for Student Teaching, they will spend two weeks in a vocational agriculture department. It is recommended that one week be before the fall school term begins and the other week immediately following the opening of the school term.

ED 412 TEACHING ADULTS **2 (1-2) f**
Principles of effective teaching applied to adult and young farmers. Experience in organizing and conducting groups for discussion of local problems.

AGRICULTURAL EDUCATION

ED 413 TEACHING MATERIALS **2 (1-2) f**
Developing and using teaching materials for more effective instruction. Experience in this area with adult and high school classes.

ED 430 SENIOR SEMINAR **1 (1-0) f s**
An analysis of the job of the teacher of vocational agriculture with particular emphasis upon current problems.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 554 PLANNING PROGRAMS OF VOCATIONAL AGRICULTURE **3 (3-0) f s**
Prerequisite: ED 411
Consideration of the community as a unit for planning programs in agricultural education; objectives and evaluation of community programs; use of advisory groups; school and community relationships; organization of the department and use of facilities.
Messrs. James, Scarborough

ED 558 SPECIAL PROBLEMS IN TEACHING **3 (3-0) f s**
Prerequisite: ED 411
Opportunities for students to study particular problems in teaching under the guidance of the staff. (Maximum of 6 credits)
Graduate Staff

ED 563 EFFECTIVE TEACHING **3 (3-0) f s**
Prerequisite: ED 411
Analysis of the teaching-learning process; assumptions that underlie course approaches; identifying problems of importance; problem solution for effective learning; relationship of learning and doing; responsibility for learnings; evaluation of teaching and learning; making specific plans for effective teaching.
Messrs. James, Scarborough

ED 568 ADULT EDUCATION IN AGRICULTURE **3 (3-0) f s**
Prerequisite: ED 411
Designed to meet the needs of teachers as leaders in adult education. More emphasis is being given to working with adults as part of the community program of vo-ag. This course will give the teacher an opportunity to study some of the basic problems and values in working with adult groups. Particular attention will be given to the problem of fitting the educational program for adults into the high school program of vo-ag, as well as to methods of teaching adults.
Messrs. James, Scarborough

COURSES FOR GRADUATES ONLY

ED 616 ADVANCED PROBLEMS IN TEACHING **3 (3-0) f s**
Prerequisite: ED 568
Group and individual study in current and advanced problems in the teaching and administration; evaluation of procedures and consideration for improving. (Maximum of 6 credits)
Graduate Staff

ED 617 PHILOSOPHY OF AGRICULTURAL EDUCATION **3 (3-0) f s**
Prerequisite: ED 554
An examination of current educational philosophies and their relation to agricultural education. Principles and practices involved in the leadership of a teacher of agriculture and in making his work more effective in a rural community. Study of leaders in the field.
Mr. Scarborough

ED 618 SEMINAR IN AGRICULTURAL EDUCATION **1 (1-0) f s**
A critical review of current problems, articles, and books of interest to advanced students in agricultural education. (Maximum of 2 credits)
Graduate Staff

ED 621 RESEARCH IN AGRICULTURAL EDUCATION **3 (3-0) f s**
Prerequisite: Advanced graduate standing
Individual direction in research on a specific problem of concern to the student. Generally, the student is preparing his thesis or research problem. (Maximum of 6 credits)
Graduate Staff

ED 664 SUPERVISION IN AGRICULTURAL EDUCATION **3 (3-0) f s**
Prerequisite: ED 563
Organization, administration, evaluation and possible improvement of present supervisory practice; theory, principles and techniques of effective supervision in agricultural education at different levels.
Messrs. Kirkland, Scarborough

AGRICULTURAL ENGINEERING

COURSES FOR UNDERGRADUATES

AGE 151, 152 FARM MECHANICS **2 (2-2) f s**
Prerequisite: Freshman in Agricultural Engineering or Mechanized Agriculture
Lecture and laboratory practice in woodworking, concrete and masonry work as applied to the design and construction of farm buildings; sharpening tools; plumbing; sheet metal and cold metal work; and electric and oxy-acetylene welding as applied to fabrication and repair work around the farm.

Messrs. Howell, Blum

AGE 201 FARM SHOP WOODWORK **2 (1-3) f s**
Lecture and laboratory practice in blueprint reading, sketching and drawing, making bills of materials, farm shop planning, sharpening and fitting tools, use of hand and power tools in repairing farm buildings and appliances.

Messrs. Howell, Blum

AGE 202 FARM SHOP METALWORK **2 (1-3) f s**
Lecture and laboratory practice in sheet metalwork, cold metalwork, arc and oxy-acetylene welding and farm shop planning.

Messrs. Howell, Blum

AGE 211 FARM POWER AND MACHINERY I **3 (2-2) f s**
A study of modern farm machinery, power units and equipment with emphasis on selection, operation, maintenance, care and adjustments from the operator's viewpoint.

Messrs. Fore, Garner

COURSES FOR ADVANCED UNDERGRADUATES

AGE 302 AGRICULTURAL DRAWING **2 (0-6) f s**
This is a course designed to study drawing-board work including sketching, elementary mechanical drawing, working drawings, lettering, tracing, blueprint reading, reproduction processes and job planning.

AGE 321 IRRIGATION, DRAINAGE AND TERRACING **3 (2-3) f s**
4 (2-6) f
Prerequisite: CE 201 for 4 credit course
Needs for irrigation in the Southeast and methods of accomplishment; methods of draining excess water from agricultural areas; the use of basic surveying equipment; and the need for and methods of accomplishing erosion control by mechanical measures to supplement vegetative programs.

Mr. Wiser

AGE 331 DAIRY ENGINEERING **3 (2-3) s**
Prerequisite: PY 211
This course embodies the application and maintance of power, heating and refrigeration to equipment and controls used in dairy manufacturing.

AGE 332 FARM BUILDINGS AND CROP PROCESSING **3 (2-3) f**
4 (2-6) f
Prerequisite: EM 341 for 4 credit course
Construction materials, structural features and design loads. Functional planning of farm buildings for housing domestic animals and for storing and handling farm crops. Curing and drying of farm crops.

AGE 341 FARM ELECTRIFICATION AND UTILITIES **3 (2-2) f**
4 (2-4) f
Prerequisite: Junior standing
Problems and general study in the proper selection and use of applicable farm electric equipment and allied utilities.

Messrs. Weaver, Blum

AGE 371 SOIL AND WATER CONSERVATION ENGINEERING **4 (3-3) f**
Prerequisites: CE 201, SOI 200
General aspects of agricultural hydrology, including precipitation, classification of climate, rainfall disposition, methods of estimating runoff, fundamental soil and water relationships, and hydraulics of flow in open channels and closed conduits, will be given. Included also are factors affecting erosion, methods of controlling erosion, land use classification, drainage, land clearing, irrigation methods, design requirements for portable irrigation systems and economic aspects of irrigation in the Southeast.

Mr. Wiser

AGRICULTURAL ENGINEERING

AGE 401 FARM SHOP ORGANIZATION AND MANAGEMENT **3 (2-2) f s**
Prerequisites: AGE 201 and 202
The use and care of power tools; planning of school shops and laboratories; selection of tools, materials and equipment; shop management; and methods of presenting the subject matter.

Messrs. Howell, Blum

AGE 411 FARM POWER AND MACHINERY IIB **3 (2-3) s**
Prerequisite: AGE 211
This course is designed to provide students in Mechanized Agriculture with a knowledge of the operations of manufacturing and distributing organizations of farm machinery and their places in these organizations. Included is a practical course in farm tractors and engines with emphasis on familiarizing the student with component parts—their application, operation and maintenance, as well as with the selection of these units from the standpoint of power, performance and ratings.

Mr. Fore

AGE 451 CURING AND DRYING OF FARM CROPS **2 (1-2) f**
Prerequisite: ME 301, EM 430 or taken concurrently
Physical properties of air, fuel and crop products as applied to the design of systems for the removal of moisture from crops. Problems involved in handling and storage in conjunction with driers.

AGE 452 SENIOR SEMINAR **1 (1-0) f s**
Students will prepare talks in their particular field of interest, presenting them to the group. Also, two or three field trips to selected points of educational opportunities will be made during the second semester. Maximum of two credits allowed.

Mr. Giles and Staff

AGE 462 FARM POWER AND MACHINERY IIA **4 (3-3) f**
Prerequisites: AGE 211, EM 321
A study of the basic principles underlying the functional elements of farm machinery, including analysis of operation, functions of various components, basic studies of processes and the service adjustment and operation of current farm equipment. The course also includes a fundamental study of internal combustion engines and power trains to the various outlets; basic designs and applications of farm tractors, including hitches, power lifts and other integral parts.

Mr. Bowen

AGE 481 FARM STRUCTURES **4 (3-3) s**
Prerequisites: AGE 451 and EM 321
Space and grouping arrangements, material use, and construction techniques to gain optimum efficiency, use and satisfaction from buildings on the farm. The design of walls and wall coverings to impair the transfer of heat and moisture. The design of building elements and their connections to withstand their imposed loads.

AGE 491 RURAL ELECTRIFICATION **4 (3-3) f**
Prerequisite: EE 320
A study of the history and development of rural electrification, rates and costs of serving the farm with electricity; farm wiring and lighting; electric motors; water systems; feed grinding and other applications of electricity to farming. Also included for study are materials and design for rural distribution lines; switches and controls; heat and refrigeration; poultry and dairy equipment; and other applicable uses of electricity in farm processes.

Mr. Weaver

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

AGE 551 SPECIAL PROBLEMS **Credits by arrangement**
Prerequisite: Senior or Graduate standing in Agricultural Engineering
Each student will select a subject on which he will do research and write a technical report on his results. He may choose a subject pertaining to his particular interest in any area of study in Agricultural Engineering.

Mr. Giles and Staff

AGE 552 INSTRUMENTATION FOR AGRICULTURAL RESEARCH AND PROCESSING **1 (0-2) f or s**
Prerequisite: EE 320
Elaboration of the theory and principles of various primary sensing elements. Relates the output signal of electrical transducers to wheatstone bridge and potentiometer measuring circuits for calibration of the signal with the variable under study. Introduces the principles of circuits and mechanisms used for indicating, recording, and/or controlling process variables. Representative equipment will be employed whenever feasible.

Mr. Hassler

COURSES FOR GRADUATES ONLY

AGE 651 RESEARCH IN AGRICULTURAL ENGINEERING **Credits by arrangement**
Prerequisite: Graduate status in Agricultural Engineering
Performance of a particular investigation of concern to Agricultural Engineering. The study will begin with the selection of a problem and culminate with the presentation of a thesis. A maximum of six credits is allowed towards a Masters Degree; no limitation on credits in Doctorate program.

Mr. Giles and Graduate Staff

AGE 652 SEMINAR **1 (1-0) f s**
Prerequisite: Graduate standing
Elaboration of subject areas, techniques and methods peculiar to professional interest through presentations of personal and published works; opportunity for students to present and defend their ideas, concepts and inferences. A maximum of two credits may be earned.

Mr. Hassler

AGE 654 AGRICULTURAL PROCESS ENGINEERING **3 (3-0) f or s**
Prerequisites: AGE 451, PY 402, MA 511
Operations employed during processing for maximizing consumer quality and economic gain. Agricultural processing operations are analyzed on a "unit operation" basis, taking into consideration physical and chemical changes. Generalized physical theory will be presented as it relates to idealizations in agricultural processing.

Mr. Hassler

AGE 661 ANALYSIS OF FUNCTION AND DESIGN OF FARM MACHINERY **3 (2-3) f or s**
Prerequisites: AGE 462, MA 401, PY 401, Statistics
Methods and tools used in determining the functional requirements of machine components; writing of machine specifications in terms of fundamental parameters; introduction of the principles of discriminate and indiscriminate mechanical selection of agricultural products with emphasis on the theory of servo-systems.

Mr. Bowen

AGE 671 THEORY OF DRAINAGE, IRRIGATION AND EROSION CONTROL **4 (3-3) f or s**
Prerequisites: AGE 371; EM 430, MA 401
Emphasis is placed on the physical and mathematical aspects of problems in conservation engineering and an attempt is made to rationalize procedures which have often come about through experience rather than through analytical considerations. Examples are presented of cases where such an analytical approach has already improved, or shows promise of improving, design criteria and procedures.

Mr. van Schilfgaarde

AGE 681 ANALYSIS OF FUNCTION AND DESIGN OF FARM BUILDINGS **4 (4-0) f or s**
Prerequisites: AGE 481 and PY 402
A study of the functional requirements of farm structures with respect to man, animals and crops and development of the means for providing structures which fulfill the functional requirements. Application of the science and art of engineering in the solution of environmental problems. Advanced planning in the integration of structural and environmental design.

Graduate Staff

AGRICULTURE

AG 101 AGRICULTURE AND WORLD AFFAIRS **3 (2-2) f**
A required course for Freshmen in the School of Agriculture except those in Agricultural and Biological Chemistry. This course deals with the agriculture and agricultural regions of the United States. It also deals with population trends and densities in relation to food production and other natural resources throughout the world.

AG 301 AGENCIES AND PROGRAMS FOR AGRICULTURE **2 (2-0) s**
A study of the major educational and service agencies designed to advance agriculture and rural living. The development of agricultural problems in the United States is traced as a background for consideration of the objectives, organization and procedures of these agencies and programs.

Mr. Sloan

AG 401 PRINCIPLES AND METHODS OF EXTENSION EDUCATION **3 (3-0) f**
Prerequisite: Senior standing (Graduate credit in special cases with permission of committee)
A study of the background, development and operation of the Agricultural Extension Service. Consideration is given to major events leading to the establishment of Agricultural Extension, its objectives, organization and philosophy. Major emphasis is placed upon the principles underlying Extension education together with methods of program building and teaching.

Mr. Sloan

ANIMAL INDUSTRY

COURSES FOR UNDERGRADUATES

AI 201 ELEMENTS OF DAIRY SCIENCE **4 (3-3) f s**
Fundamental principles of milk production; breeds, selection, feeding and management of dairy cattle; composition, quality and food value of milk products; principles of processing and manufacturing dairy products.

Messrs. Haig, Warren

AI 202 FUNDAMENTALS OF ANIMAL HUSBANDRY **4 (3-3) f s**
Principles of feeding, managing and marketing meat animals. Year to year and seasonal price trends and relationships. Relation of slaughter grades to carcass cut-out values.

Mr. Wise

AI 301 GRADING AND SELECTING MEAT ANIMALS **2 (0-6) s**
Study of breed characteristics and type by species. Market classes and grades of beef cattle, sheep and hogs relating live animal grade to carcass grade and cut-out value.

Mr. Gregory

AI 303 MEAT AND MEAT PRODUCTS **3 (1-6) s**
Study of live animal and carcass relationship, dressing percentages and cut-out values. Slaughtering, cutting, curing, freezing and handling of meat and meat products for commercial and home use.

Messrs. Blumer, Craig

AI 305 SELECTING DAIRY CATTLE **2 (0-6) f**
A study of dairy breed organization, functions, herd books and pedigree writing. Correlation of type and performance of dairy cattle and practice in oral expression of type.

Mr. Murley

AI 306 SELECTING DAIRY CATTLE (ADVANCED) **1 (0-3) s**
Prerequisite: AI 305 and approval of instructor
Advanced study on correlation of type and performance of dairy cattle with emphasis on oral expression of type. A study of show-ring classification and practice in fitting and showing of animals.

Mr. Murley

AI 307 ADVANCED SELECTION AND EVALUATION OF LIVESTOCK **1 (0-6) f**
Prerequisite. AI 301
Study of standards of animal excellence stressing the importance of methods in making rapid observations and appraisals and formulating logical and accurate decisions. Practice in oral expression will be provided.

Mr. Gregory

AI 309 MEAT SELECTION **1 (0-6) f**
Detailed consideration of factors involved in selection of carcasses and wholesale cuts of beef, pork and lamb. Practice in indentification of wholesale and retail cuts.

Mr. Blumer

AI 312 PRINCIPLES OF LIVESTOCK NUTRITION **3 (3-0) s**
Prerequisite: CH 431 and ZO 301
Fundamentals of modern animal nutrition, including classification of nutrients, their general metabolism and roles in productive functions.

Mr. Ramsey

AI 401 BEEF CATTLE PRODUCTION **3 (2-3) s**
Prerequisite: AI 202
Fundamental principles of the production of beef; selection, feeding and management of breeding herds and feeder cattle.

Mr. Gregory

AI 402 SHEEP PRODUCTION **3 (2-3) s**
Prerequisite: AI 202
Study of the factors involved in the feeding, breeding, management and marketing of lamb, mutton and wool.

Mr. Ellis

AI 403 PORK PRODUCTION **3 (2-3) f**
Prerequisite: AI 202
Study of production, management and marketing practices involved in the successful production of swine.

Mr. Clawson

AI 404 DAIRY FARM PROBLEMS **3 (2-3) s**
Prerequisite: AI 201
Advanced study of practical dairy farm management including farm records, farm buildings, sanitation, roughage utilization and herd culling.

Mr. Murley

AI 406 ANIMAL INDUSTRY SEMINAR **1 (1-0) s**
Review and discussion of special topics and the current literature pertaining to all phases of animal production.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

AI 501 PHYSIOLOGY OF DOMESTIC ANIMALS **4 (3-3) f**
Prerequisite: ZO 301
A course in advanced physiology of domestic mammals with special reference to farm animals.

Messrs. Thomas, Ulberg, Wise

AI 502 REPRODUCTION AND LACTATION **4 (3-3) s**
Prerequisite: ZO 301
Anatomy and physiology of the reproductive organs and mammary glands with detailed coverage of physiological processes involved and factors controlling and influencing them. Specific applications to farm animals including artificial insemination.

Messrs. Mochrie, Myers, Ulberg

AI 503 ANIMAL BREEDING **3 (2-3) f**
Prerequisite: GN 411
Traits of economic importance in livestock production, and their mode of inheritance. Phenotypic and genetic relationships between traits. The place of selection, inbreeding and crossbreeding in a program of animal improvement.

Mr. Farthing

AI 505 DISEASES OF FARM ANIMALS **3 (3-0) f**
Prerequisite: CH 101, 203; BO 421 desired
The pathology of bacterial, virus, parasitic, nutritional and thermal diseases, and mechanical disease processes.

Mr. Osborne

AI 507 TOPICAL PROBLEMS IN ANIMAL INDUSTRY **Max. 6 f s**
Special problems may be selected or assigned in various phases of Animal Industry. A maximum of six credits is allowed.

Staff

AI 513 NEEDS AND UTILIZATION OF NUTRIENTS BY LIVESTOCK **3 (3-0) f**
Prerequisite: AI 312 or equivalent
Measurement of nutrient needs of livestock and the nutrient values of feeds. Nutritive requirements for productive functions.

Mr. Wise

COURSES FOR GRADUATES ONLY

AI 600 RESEARCH IN ANIMAL INDUSTRY **Credits by Arrangement f s**
A maximum of six hours is allowed toward the Master's degree; no limitation on credits in Doctorate programs.

Graduate Staff

AI 601 SEMINAR IN ANIMAL NUTRITION **1 (1-0) f s**
Prerequisite: Permission of seminar leaders
Orientation in philosophy of research; organization for research in agriculture, and general research methodology.

Nutrition Staff

AI 602 ADVANCED ANIMAL BREEDING **3 (Arranged) f**
Prerequisite: ST 512, GN 512
A study of the forces influencing gene frequencies, inbreeding and its effects, and alternative breeding plans.

Mr. Legates

AI 603 ANIMAL NUTRITION: MINERAL METABOLISM **3 (3-0) f**
Prerequisite: CH 551
Role of minerals in the nutrition of animals with emphasis on available knowledge, a digest of progress already made and directions in which investigations need to be extended.

Mr. Matrone

AI 614 (BO 614) PHYSIOLOGY OF MICROORGANISMS **2 (2-1) s**
Prerequisites: BO 312, CH 551
A study of the physical structure and chemical composition of microorganisms; the influence of physical and chemical agents on growth and reproduction; the metabolism of carbohydrates, proteins and lipids.

Mr. McNeill

AI 621 (CH 621) ENZYMES AND INTERMEDIARY METABOLISM **4 (3-4) f**
Prerequisites: CH 511 and permission of instructor
A study of the properties of enzymes and enzyme action; intermediary metabolism of carbohydrates, amino acids, fatty acids, vitamins, purines and phorphrins; metabolic energy relationships.

Mr. Tove

AI 623 (CH 623) BIOLOGIAL ASSAY OF VITAMINS **3 (2-2) s**
Prerequisites: CH 551, ST 512
Techniques and designs of biological assays for vitamins. The interrelationship of logical principles, design and analysis is emphasized.

Graduate Staff

ANTHROPOLOGY

See Sociology and Anthropology

ARCHITECTURE

COURSES FOR UNDERGRADUATES

ARC 101-102 INTRODUCTION TO ARCHITECTURE **2 (1-3) f s**
The application of the basic principles and fundamentals of design to architecture. The elements of descriptive geometry, architectural shades and shadows and perspective.

Staff

ARC 301-302 ARCHITECTURAL DESIGN I, II **6 (3-12) f s**
Prerequisites: Design 202-212, EM 311, PY 212
Required of all third year students in Architecture Relationship of exterior and interior spaces. Structure as a primary and essential element in construction and design.

Messrs. Elliott, Taylor

ARC 401-402 ARCHITECTURAL DESIGN III, IV **6 (3-12) f s**
Prerequisites: ARC 302, CE 339, EM 321
Required of all fourth year students in Architecture. A study of architectural design process as applied to larger buildings and groups of buildings. Introductory exercise in theory and practice of physical city planning.

Mr. Matsumoto

ARC 501-502 ARCHITECTURAL DESIGN V, VI **6 (3-12) f s**
Prerequisites: ARC 402, CE 436
Required of all fifth year students in Architecture Research Design.

Mr. Caminos

BIOLOGY

BI 301 FUNDAMENTALS OF BIOLOGY **3 (3-0) s**
A survey of the major principles of the biological sciences. A course designed for students who have not had a college course in the biological sciences and who do not anticipate further study in biology. Not acceptable as a prerequisite for further work in the biological sciences.

Staff

BOTANY

COURSES FOR UNDERGRADUATES

BO 101 GENERAL BOTANY **3 (3-0) f s**
An introductory study of the structure, physiology and ecology of higher green plants.

Staff

BO 102 GENERAL BOTANY **3 (3-0) f s**
Prerequisite: BO 101
A study of sexual reproduction and heredity in the flowering plants; a survey of the life histories of the major groups of non-green and green plants.

Staff

BO 211, 212 DENDROLOGY **2 (1-3) f s**
Prerequisite: BO 102
Must be taken in the order listed except by permission
A systematic survey of the principal hardwood (angiosperm) and evergreen (gymnosperm) genera and species of North American trees. Emphasis is upon those of commercial significance and particularly those in the eastern United States.
Mr. Hardin

BO 312 GENERAL BACTERIOLOGY **4 (2-4) f s**
Prerequisites: BO 102 or ZO 101; CH 101
Open to students in Sanitary Engineering with only the chemistry prerequisite
A study of the basic concepts and techniques of bacteriology; isolation, cultivation, observation, morphology, physiology and nutrition of microorganisms.

BO 403 SYSTEMATIC BOTANY **3 (0-6) s**
Prerequisite: BO 102
A systematic survey of vascular plants emphasizing field identification, terminology and general evolutionary relationships.
Mr. Beal

BO 410 PLANT HISTOLOGY AND MICROTECHNIQUE **3 (1-6) f**
Prerequisites: BO 102; CH 203
Studies of the principal tissues of Angiosperms in terms of the theory and practice of optical instrumentation, microtechnical preparations and photomicrography.
Mr. Ball

BO 421 PLANT PHYSIOLOGY **4 (2-4) f s**
Prerequisites: BO 102; CH 203 or 103
An introductory treatment of the chemical and physical processes occurring in higher green plants with emphasis upon the mechanisms, factors affecting, correlations between processes, and biological significance.
Mr. Scofield

BO 441 PLANT ECOLOGY **3 (2-3) f**
Prerequisite: BO 102
A study of the principles and factors determining the distribution of plants including discussion of the major groupings of plants into vegetational types.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

BO 512 MORPHOLOGY OF VASCULAR PLANTS **2 (1-3) f**
Prerequisite: BO 102
A study of comparative morphology, ontogeny and evolution of the vascular plants. Emphasis is placed upon the phylogeny of sexual reproduction and of the vascular systems.
Mr. Ball

BO 513 PLANT ANATOMY **3 (2-2) s**
Prerequisite: BO 102
A study of the anatomy of the Angiosperms and Gymnosperms. The development of tissues is traced from their origin by meristems to their mature states.
Mr. Ball

BO 521 SYSTEMATIC BOTANY OF MONOCOT FAMILIES **3 (0-6) f**
Prerequisites: BO 102, 403
A comprehensive survey of the systematics of monocot families with special emphasis on grasses. Terminology, identification, relationships and economic significance are stressed.
Mr. Beal

BO 523 SYSTEMATIC BOTANY OF DICOT FAMILIES **3 (0-6) s**
Prerequisites: BO 102, 403
A comprehensive survey of the systematics of dicot families. Emphasis is given to the history of systematics, its significance and relation to other disciplines, the principles of plant classification, major systems of classification and the International Rules of Botanical Nomenclature.
Mr. Hardin

BO 532, 533 ADVANCED PLANT PHYSIOLOGY **2 (2-0) f s**
Prerequisite: BO 421 or equivalent
An advanced treatment of biophysical and biochemical processes and growth in higher green plants with emphasis upon the theoretical principles which form the basis for interpretations.
Mr. Troyer

CERAMIC ENGINEERING

BO 545 ADVANCED PLANT ECOLOGY **3 (2-3) s**
Prerequisites: BO 421, 441 or equivalent
An advanced discussion of the principles, theories and methods of plant ecology.

BO 573 AQUATIC BOTANY **3 (1-6) s**
Prerequisite: BO 102
A discussion of the taxonomy and ecology of the aquatic plants including the important fresh-water algae, aquatic bacteria, fungi, water "ferns", mosses and liverworts, and the important genera of flowering plants.

Mr. Whitford

COURSES LIMITED TO GRADUATE STUDENTS

BO 614 PHYSIOLOGY OF MICRO-ORGANISMS **3 (2-3) s**
(See AI 614)

BO 635 THE MINERAL NUTRITION OF PLANTS **3 (2-3) s**
Prerequisites: BO 421 and a course in Biochemistry
Discussion of the accumulation, translocation and utilization of mineral elements by higher plants. Emphasis will be placed on the relationships between these processes and plant metabolism.

Mr. Evans

BO 650 SPECIAL PROBLEMS IN BOTANY **Credits by arrangement f s**
Graduate students in fields allied to Botany may conduct intensive study of a problem in some specialized phase of botany.

Graduate Staff

BO 651 RESEARCH IN BOTANY **Credits by arrangement f s**
Graduate student majors in Botany undertake research problems preparatory to writing a Master's Thesis or a PhD Dissertation.

Graduate Staff

BO 661 BOTANY SEMINAR **1 (1-0) f s**
Graduate student credit allowed if one paper per semester is presented at Seminar.
Graduate Staff

CERAMIC ENGINEERING

COURSES FOR UNDERGRADUATES

MIC 210 CERAMIC MATERIALS AND PROCESSES **3 (2-3) f s**
Designed for students not majoring in Ceramic Engineering. Includes raw materials, forming processes, effect of thermal treatment, properties and uses of ceramic products. Lecture and Laboratory.

MIC 301 CERAMIC OPERATIONS I **4 (3-3) f**
Prerequisite: MIM 201
Unit operations pertaining to ceramic product manufacture. Crushing, grinding, particle size classification and packing. Colloidal and rheological properties of slips, slurries and plastic masses. Lectures and laboratory.

MIC 302 CERAMIC OPERATIONS II **3 (2-3) s**
Prerequisites: MIC 301 and PY 201
A continuation of MIC 301. Dewatering of slips and slurries. Properties of air and air-vapor mixtures, heat transmission, fluid flow, drying, drier calculations, furnaces, kilns and kiln calculations. Lecture and Laboratory.

MIC 312 CERAMIC PROCESS PRINCIPLES I **4 (3-3) s**
Corequisite: MIC 302
Effect of heat on non-metallic minerals. Thermodynamic calculations. Industrial fuels and combustion, review of heterogeneous equilibria. Crystal structures. Pyrochemical and pyrophysical changes in ceramic bodies. Lecture and Laboratory.

MIC 413 CERAMIC PROCESS PRINCIPLES II **4 (3-3) f**
Prerequisites: MIC 312 and CH 532
A continuation of MIC 312. A study of the glassy state to include structure of glass, properties and types of glasses. Glazes, enamels, opacity, color and devitrification. Nature of glassy phases in kiln fired ceramic bodies. Lecture and Laboratory.

MIC 414 SENIOR THESIS **3 (1-6) f s**
One semester required of seniors in Ceramic Engineering. A second semester may be elected An introduction to research. Literature search, laboratory investigation and written report in the form of a thesis. Conference and laboratory.

MIC 415, 416 CERAMIC ENGINEERING DESIGN **2 (0-6) f s**
The methods of ceramic equipment, structures and plant designing.

MIC 420 INDUSTRIAL CERAMICS **3 (3-0) s**
A study of the various ceramic Industries, including manufacturing techniques, labor and professional relationships, and the present and future status of the respective industries. Lectures and discussion.

MIC 425 SEMINAR **1 (1-0) f s**
One semester required of seniors in Ceramic Engineering. A second semester may be elected Literature survey of selected topics in ceramic engineering. Oral and written reports, discussions.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MIC 503 CERAMIC MICROSCOPY **3 (2-3) f s**
Prerequisite: MIC 531
Petrographic techniques for the systematic study of ceramic materials and products. Interpretation and representation of results.

MIC 505 RESEARCH AND CONTROL METHODS **3 (2-3) s**
Prerequisite: MIC 413
Interpretation of results, instrumental methods applied to research and product development. Statistical quality control.

MIC 507, 508 ADVANCED CERAMIC EXPERIMENTS **3 (1-6) f s**
Prerequisite: MIC 414 or equivalent
Advanced studies in ceramic laboratory experimentation.

MIC 511 ADVANCED STUDIES IN FIRING **3 (2-3) f s**
Prerequisite: MIC 413
Advanced studies of ceramic firing procedures with emphasis on the design, calculation and economic evaluation of kilns and furnaces.

MIC 522 STRUCTURAL CLAY PRODUCTS **3 (3-0) s**
Prerequisite: MIC 413
The technology of the structural clay products industries with emphasis on the latest developments in the field.

MIC 526 REFRACTORY TECHNOLOGY **2 (2-0) s**
Prerequisite: MIC 413
The technology of refractory manufacture with emphasis on the latest advances in the field.

MIC 527 REFRACTORIES IN SERVICE **3 (2-3) f s**
Prerequisite: CH 532
A study of the physical and chemical properties of the more important refractories in respect to their environment in industrial and laboratory furnaces.

MIC 532 TECHNOLOGY OF ABRASIVES **2 (2-0) s**
Prerequisite: MIC 413
The methods of manufacture, properties and application of abrasives to industrial grinding, cutting and polishing.

MIC 535, 536 ENAMELS AND PROTECTIVE COATINGS **3 (3-0) f s**
Prerequisite: MIC 413
The technology of ceramic coatings for ferrous, aluminum and special high temperature alloys used for domestic appliances, structural members aircraft parts, etc.

MIC 540 GLASS TECHNOLOGY **3 (3-0) s**
Prerequisite: MIC 413
Fundamentals of glass manufacture including compositions, properties and applications of the principal types of commercial glasses.

MIC 543, 544 TECHNOLOGY OF THE WHITEWARE INDUSTRIES **3 (3-0) f s**
Prerequisite: MIC 413
Technology of whiteware bodies and glazes.

MIC 548 TECHNOLOGY OF CEMENTS **3 (3-0) s**
Prerequisite: MIC 413
The technology of the Portland cement industry including manufacture, control and uses.

CHEMICAL ENGINEERING

COURSES FOR GRADUATES ONLY

MIC 605, 606 CRYSTAL STRUCTURES **2 (2-0) f s**
Prerequisite: CH 532
Basic laws of crystal structure. Relation of crystal structure to chemical and physical properties.

MIC 613 CERAMIC THERMAL MINERALOGY **3 (3-0) s**
Prerequisite: MIC 605
Applications of the principles of thermalchemical mineralogy to ceramic problems.

MIC 650 CERAMIC RESEARCH **1 to 9 credits per semester**
An original and independent investigation in ceramic engineering. A report of such an investigation is required as a graduate thesis.

MIC 660 CERAMIC ENGINEERING SEMINAR **1 (1-0) f s**
Reports and discussion of special topics in ceramic engineering and allied fields.

MIC 661, 662 SPECIAL STUDIES IN CERAMIC ENGINEERING **1 to 3 credits per semester**
Special studies of advanced topics in ceramic engineering. Credit will vary with the topic.

CHEMICAL ENGINEERING

COURSES FOR UNDERGRADUATES

CHE 205 CHEMICAL PROCESS PRINCIPLES **4 (3-2) f**
Prerequisites: MA 102, CH 103
Required of sophomores in Chemical Engineering
The calculation of material and energy balances, stoichiometry, gas laws, vapor pressure, humidity, saturation, thermophysics and thermochemistry. Three lectures and one problem period.

CHE 301, 302 ELEMENTS OF CHEMICAL ENGINEERING **3 (3-0) f s**
An introduction to principles of chemical engineering including calculations involved in industrial processes and equipment. The course is designed for students not majoring in chemical engineering.

CHE 311 INTRODUCTORY CHEMICAL ENGINEERING **4 (3-3) s**
Prerequisite: CHE 205
Required of sophomores in Chemical Engineering
A continuation of CHE 205. One laboratory period is devoted to typical chemical engineering measurements.

CHE 411 UNIT OPERATIONS I **3 (3-0) s**
Prerequisite: MA 202, PY 202
Required of juniors in Chemical Engineering
Principles of fluid flow, heat transfer, evaporation, etc., with emphasis on design calculations.

CHE 412 UNIT OPERATIONS II **3 (3-0) f**
Prerequisite: CHE 411
Required of seniors in Chemical Engineering
A continuation of CHE 411 with emphasis on the diffusional operations such as absorption, distillation, extraction, drying, etc.

CHE 415 CHEMICAL ENGINEERING THERMODYNAMICS **4 (3-2) f**
Prerequisite: CHE 311
Required of juniors in Chemical Engineering
A study of the laws of thermodynamics and their application to chemical engineering problems. Emphasis on the theory, data and approximation methods as applied to physical and chemical systems.

CHE 431, 432 UNIT OPERATIONS LABORATORY I AND II **3 (1-6) f s**
Prerequisite: CHE 411
Required of seniors in Chemical Engineering
Laboratory work on typical apparatus involving the unit operations. Experiments are designed to augment the theory and data of the lecture courses and to develop proficiency in the writing of technical reports.

CHE 453 CHEMICAL PROCESSING OF RADIOACTIVE MATERIALS **3 (3-0)**
Consideration of the unique procedures required for the bulk manipulation of radioactive chemicals. Particular attention is given to remote operational procedures of precipitation, centrifugation, conveying, solvent extraction and ion exchange. Design of apparatus involving low maintenance and ease of replacement and cleaning by safe methods is considered. Other topics include decontamination procedures and disposal of wastes.

CHE 460 SEMINAR **1 (1-0) f s**
One semester required of seniors in Chemical Engineering.
Literature survey of selected topics in chemical engineering. Emphasis on written and oral presentation.

CHE 470 CHEMICAL ENGINEERING PROJECTS **2 Arrange f s**
Elective for seniors in Chemical Engineering
Introduction to research through experimental, theoretical and literature studies of chemical engineering problems. Oral and written presentation of reports.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

CHE 525 PROCESS MEASUREMENT AND CONTROL **3 Arrange f s**
Prerequisite: CHE 411
Theory and application of methods for measuring, transmitting, recording and controlling such process variables as temperature, pressure, flow rate, liquid level, concentration, humidity, etc. Commercial instruments are utilized for study of a wide variety of industrial control problems. Recorder-controllers are available for simulating industrial control problems of varying difficulty.

CHE 527 CHEMICAL PROCESS ENGINEERING **3 (3-0) s**
Prerequisite: CHE 412
A study of selected chemical processes with emphasis on the engineering, chemical and economic factors involved.

CHE 540 ELECTROCHEMICAL ENGINEERING **3 (3-0) s**
Prerequisite: Physical Chemistry
The application of electrochemical principles to such topics as electrolysis, electroanalysis, electroplating, metal refining, etc.

CHE 541 CELLULOSE INDUSTRIES **3 (3-0) f**
Prerequisite: Organic Chemistry
Methods of manufacture and application of cellulose chemical conversion products. Emphasis placed on recent development in the fields of synthetic fibers, films, lacquers and other cellulose compounds.

CHE 542 TECHNOLOGY OF PULP AND PAPER **3 Arrange f**
Prerequisite: Organic Chemistry
Fundamentals of pulp and paper manufacture with emphasis on recent advances in the field. One laboratory period per week is devoted to topics such as digestion and treatment of pulp, handsheet preparation and testing, fiber analysis and chemical and physical tests.

CHE 543 TECHNOLOGY OF PLASTICS **3 (3-0) s**
Prerequisite: Organic Chemistry
The properties, methods of manufacture and application of synthetic resins. Recent developments in the field are stressed.

CHE 545 PETROLEUM REFINERY ENGINEERING **3 (3-0) s**
Prerequisite: CHE 412
An introduction to the petroleum industry including (1) nature of petroleum and its fractions, octane numbers, viscosity relationships, etc., (2) operations of thermal and catalytic cracking, stabilization, alkylation isomerization, crude fractionation, etc., (3) problem work covering high pressure phase relationships and related material.

CHE 546 CHEMICAL REACTION RATES **3 (3-0) f**
Prerequisite: CHE 415
A basic study of the rates of homogeneous reactions, heterogeneous reactions and catalysis.

CHE 551 THERMAL PROBLEMS IN NUCLEAR ENGINEERING **3 (3-0)**
Prerequisite: ME 302 or 303; or CHE 411; or equivalent
The design and operation of nuclear reactors and the utilization of the power from them involves major problems in nearly every phase of heat transfer, and many important problems in fluid flow. Possible solutions to these problems are severely affected by the influences of radiation on heat transfer media, hazards of handling radioactive substances, etc. The course considers the thermal problems of nuclear reactor design and the principles of fluid flow and heat transfer necessary to their solutions.
The course is intended for engineers and science students with backgrounds in physics and mathematics and elementary thermodynamics.

CHE 553 SEPARATION PROCESSES IN NUCLEAR ENGINEERING **3 (3-0)**
Prerequisite: CHE 412, or equivalent
A study of the principles and techniques of separation and purification of chemical components, based upon mass transfer by diffusion. Specific techniques covered are distillation, extraction, adsorption and ion exchange, particularly in regard to continuous, counter-current operations. Special topics include a survey of fuel processing, technology of uranium processing, complexing action of solvents and halide distillation.
The course is primarily intended for engineers and science students with backgrounds in mathematics, physics and elementary chemistry but who have had no previous course in separation processes.

CHE 570 CHEMICAL ENGINEERING PROJECTS **3 Arrange f s**
Prerequisite or concurrent: CHE 412
A laboratory study of some phase of chemical engineering or allied field.

COURSES FOR GRADUATES ONLY

CHE 610 HEAT TRANSFER I **3 (3-0) f**
Prerequisite: CHE 411
An advanced course dealing primarily with heat transfer between liquids and solids, optimum operating conditions and design of equipment, conduction, heating and cooling of solids, radiant heat transmission.

CHE 611 HEAT TRANSFER II **2 (2-0) s**
Prerequisite: CHE 610
An intensive study of recent advances in heat transfer and allied fields.

CHE 612 DIFFUSIONAL OPERATIONS **3 (3-0) f**
Prerequisite: CHE 412
An advanced treatment of mass transfer particularly as applied to absorption, extraction, drying, humidification and dehumidification.

CHE 613 DISTILLATION **3 (3-0)**
Prerequisite: CHE 412
Vapor-liquid equilibria of non-ideal solutions, continuous distillation of binary and multi-component systems, batch distillation, azeotropic and extraction distillation.

CHE 614 DRYING OF SOLIDS **2 (2-0)**
Prerequisite: CHE 412
An advanced course on the mechanism of drying operations with application to design of equipment, such as cabinet, tunnel, rotary, drum and spray driers.

CHE 615 THERMODYNAMICS I **3 (3-0) f**
Prerequisite: CHE 415
Advanced topics in Chemical Engineering thermodynamics including equilibria of physical and chemical systems, high pressure systems, generalized properties of hydrocarbons, etc.

CHE 616 THERMODYNAMICS II **2 (2-0) s**
Prerequisite: CHE 615
An intenstive study of recent advances in thermodynamics.

CHE 617 CATALYSIS OF INDUSTRIAL REACTIONS **3 (3-0)**
Prerequisite: CHE 546
A study of the mechanism of catalysis with emphasis on practical application to operation and design of industrial processes.

CHE 631, 632 CHEMICAL PROCESS DESIGN **3 (3-0) f s**
Prerequisite: CHE 412
Design and selection of process equipment, through solution of comprehensive problems involving unit operations, kinetics, thermodynamics, strength of materials and chemistry.

CHE 641, 642 ADVANCED CHEMICAL ENGINEERING LABORATORY **2 Arrange f s**
Prerequisite: CHE 412
Advanced laboratory work in a selected field with emphasis on theory, techniques and performance of equipment.

CHE 650 ADVANCED TOPICS IN CHEMICAL ENGINEERING **1 to 3 credits per semester f s**
A study of recent developments in chemical engineering theory and practice, such as ion exchange, crystallization, mixing, molecular distillation, hydrogenation, fluorination, etc. The topic will vary from term to term.

CHE 660 CHEMICAL ENGINEERING SEMINAR **1 credit per semester f s**
Literature investigations and reports of special topics in chemical engineering and allied fields.

CHE 680 CHEMICAL ENGINEERING RESEARCH **1 to 9 credits per semester f s**
Independent investigation of an advanced chemical engineering problem. A report of such an investigation is required as a graduate thesis.

CHEMISTRY

COURSES FOR UNDERGRADUATES

CH 101 GENERAL INORGANIC CHEMISTRY **4 (3-2) f s**
The language of Chemistry, fundamental chemical laws and theories, limited study of selected chemical elements, compounds, reactions and processes.

Staff

CH 103 GENERAL AND QUALITATIVE CHEMISTRY **4 (3-2) f s**
Prerequisite: CH 101
Homogeneous and heterogeneous equilibrium, oxidation and reduction, metallurgy, fundamental properties of metals, non-metals, their compounds, introduction to organic and nuclear chemistry, industrial applications of some metals, non-metals and their compounds. The laboratory work is entirely semimicro qualitative analysis.

Staff

CH 103 L SEMIMICRO QUALITATIVE ANALYSIS **1 (0-3) f s**
Prerequisite: 1 year of General Chemistry not including Qualitative Analysis
Chiefly the laboratory work of CH 103.

CH 201 GENERAL INORGANIC CHEMISTRY **5 (3-6) f**
Includes content of CH 101 supplemented by additional laboratory work.

Staff

CH 203 GENERAL AND ORGANIC CHEMISTRY **4 (3-3) f s**
Prerequisite: CH 101
Chemistry 203 includes a further study of the principles of general chemistry as presented in CH 101, and also an introduction to Organic Chemistry. The Organic Chemistry survey includes the hydrocarbons, alcohols, ethers, aldehydes, ketones, acids and derivatives, esters, phenols, fats, carbohydrates, amino acids, proteins and a selected group of natural and synthetic products.

Staff

CH 205 GENERAL AND QUALITATIVE CHEMISTRY **5 (3-6) s**
Prerequisite: CH 101 or 201
Includes content of CH 103 supplemented by additional laboratory work.

Staff

CH 211 QUANTITATIVE ANALYSIS **4 (2-6) f**
Prerequisite: CH 103
Volumetric analysis, including the techniques, chemistry, stoichiometry and basic chemical principles of neutralization, oxidation and precipitation analysis with laboratory application to representative analyses.

Mr. Hentz

CH 212 QUANTITATIVE ANALYSIS **4 (2-6) s**
Prerequisites: CH 211 and one semester of General Physics
Continuation of CH 211 to the study of potentiometric titrations, colorimetry, pH measurement, electrodeposition and gravimetric methods of analysis with representative laboratory applications.

Mr. Hentz

CH 215 QUANTITATIVE ANALYSIS **4 (3-3) f s**
Prerequisite: CH 103
One semester course in Volumetric and Gravimetric analysis. Includes techniques, stoichiometry and principles of neutralization, oxidation and precipitation methods, and the chemistry of representative laboratory determinations.

Mr. Hentz

CH 401 SPECIAL TOPICS IN INORGANIC CHEMISTRY **3 (3-0) f**
Prerequisite: CH 215
Structure of matter, periodic system, electronic structure and chemical bonding, acids, bases, salts, preparation of elements, halogen compounds, hydrides and carbonyls.

Messrs. Hentz, White

CH 421, 422 ORGANIC CHEMISTRY **5 (3-6) f s**
Prerequisite: CH 212
Aliphatic and aromatic compounds, methods of preparation, purification and identification of compounds; emphasis on structure and mechanism of organic reactions.

Mr. Reid

CH 425, 426 ORGANIC CHEMISTRY **3 (2-3) f s**
Prerequisite: CH 215
Structure, preparation, properties and reactions of aliphatic and aromatic substances.

Mr. Loeppert

CHEMISTRY

CH 430 ORGANIC PREPARATIONS **3 (1-6) s**
Prerequisites: Three years of Chemistry including Organic Chemistry
Experiments selected to acquaint the student with advanced methods and techniques in the preparation of organic substances.

Mr. Loeppert

CH 451 INTRODUCTORY BIOCHEMISTRY **3 (2-3) f s**
Prerequisite: CH 203
The fundamental biochemistry of living matter.

Mr. Satterfield

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

CH 527 ADVANCED SURVEY OF ORGANIC CHEMISTRY **3 (3-0) s**
Prerequisites: Three years of Chemistry including Organic Chemistry
Underlying principles, interpretation of mechanisms, limitations in the use of organic reactions.

Mr. Reid

CH 528 QUALITATIVE ORGANIC ANALYSIS **3 (1-6) f**
Prerequisites: Three years of Chemistry including Organic Chemistry
A study of class reactions, functional groups, separation, identification. Preparation of derivatives.

Mr. Reid

CH 529 QUANTITATIVE ORGANIC ANALYSIS **3 (1-6) s**
Prerequisites: Three years of Chemistry including Organic Chemistry
Quantitative determination of carbon, hydrogen, nitrogen, the halogens, sulfur and various functional groups in organic materials, with emphasis on semimicro methods.

Mr. Loeppert

CH 531, 532 PHYSICAL CHEMISTRY **3 (3-0) f s**
Prerequisites: CH 215, PY 202, MA 202
An intensive study of the states of matter, solutions, colloids, homogeneous and heterogeneous equilibrium, reaction kinetics, electrolysis, conductance, oxidation reactions and ionic equilibrium.

Mr. Sutton

CH 531 L, 532 L PHYSICAL CHEMISTRY LABORATORY **1 (0-3) f s**
Prerequisites: CH 215, PY 202, MA 202
Laboratory course to accompany lecture work in physical chemistry.

Mr. Sutton

CH 533 PHYSICAL CHEMISTRY **3 (3-0) f**
Prerequisite: CH 532
An intensive study of the structure of atoms and molecules, an introduction to statistics and selected subjects in thermodynamics.

Mr. Hentz

CH 537 INSTRUMENTAL METHODS OF ANALYSIS **4 (2-6) s**
Prerequisites: Three years of Chemistry including CH 532
Physical methods of chemical analysis, the instruments employed and the theoretical basis for their operation.

Mr. Long

CH 542 COLLOID CHEMISTRY **3 (2-3) s**
Prerequisite: CH 426
Adsorption, preparation, properties, constitution, stability, and application of sols, gels, emulsions, foams and aerosols; dialysis, Donnan membrane equilibrium.

Mr. White

CH 543 RADIOCHEMISTRY **3 (2-3) s**
Prerequisites: CH 215 or 212, PY 520
Chemical techniques applied to separation of radioactive elements and preparation for counting. Applications of radioactivity to chemistry.

Mr. Hentz

CH 551 GENERAL BIOLOGICAL CHEMISTRY **5 (3-6) f**
Prerequisites: CH 422, or equivalent of three years of Chemistry
The chemical constitution of living matter. Biochemical processes as well as compounds are studied.

Messrs. Peterson, Simmons

CH 552 PHYSIOLOGICAL CHEMISTRY **3 (2-3) s**
Prerequisite: CH 551
Digestion, absorption, metabolism, secretions and excretions. Laboratory will include analysis of blood and urine.

Mr. Satterfield

CH 555 PLANT CHEMISTRY **3 (2-3) s**
Prerequisite: CH 551
Composition of plants, properties, nature, and classification of plant constituents, changes occurring during growth, ripening and storage of plants or plant products.

Mr. Simmons

CH 561 CHEMISTRY OF CARBOHYDRATES AND LIPIDES **3 (3-0) s**
Prerequisites: CH 422 or equivalent of three years of Chemistry
Classification, composition, distribution, biosynthesis and metabolism of lipides and carbohydrates, analysis, syntheses, deterioration. Physical properties and chemical reactions are also considered.

Messrs. Robinson, Simmons

CH 562 CHEMISTRY OF PROTEINS AND NUCLEIC ACIDS **3 (3-0) f**
Prerequisites: CH 422, CH 551, or equivalent of three years of Chemistry
Composition, distribution, structure, properties and metabolism of amino acids, proteins and nucleic acids.

Messrs. Peterson, Simmons

CH 572 CHEMISTRY OF THE VITAMINS **3 (3-0) s**
Prerequisites: CH 422, or equivalent of three years of Chemistry
History, nomenclature, properties, distribution, effects of deficiencies, vitamin values.

Mr. Satterfield

CH 601 ADVANCED ORGANIC CHEMISTRY **3 (3-0) f**
Prerequisite: CH 527
Alicyclic and heterocyclic compounds, macromolecules. Standard type reactions.

Messrs. Reid, Loeppert, Robinson

CH 602 ADVANCED ORGANIC CHEMISTRY **3 (3-0) s**
Prerequisites: CH 422, 532
Theoretical and physical aspects of Organic Chemistry; relations between chemical constitution and properties.

Mr. Loeppert

CH 621 (AI 621) ENZYMES AND INTERMEDIARY METABOLISM **4 (3-3) f**
Prerequisites: CH 551
A study of the properties of enzymes and enzyme action, intermediary metabolism of carbohydrates, amino acids, fatty acids, vitamins, purines and porphyrins, metabolic energy relationships.

Mr. Tove

CH 623 (AI 623) BIOLOGICAL ASSAY OF VITAMINS **3 (2-2) s**
Prerequisites: CH 551 or AI 312, ST 512
Techniques and designs of biological assays for vitamins; the interrelationships of logical principles, design and analysis is emphasized.

Graduate Staff

CH 631 CHEMICAL RESEARCH **Credits by arrangement**
Prerequisites: 40 semester credits in Chemistry. Open to all graduates
Special problems that will furnish material for a thesis. A maximum of 6 semester credits is allowed toward a Master's degree, no limitation on credits in Doctorate programs.

Graduate Staff

CH 641 SEMINAR **Credits by arrangement**
Prerequisite: Graduate standing in Chemistry
Required of graduate students specializing in Chemistry
Scientific articles, progress reports in research, and special problems of interest to chemists are reviewed and discussed.
A maximum of two semester credits is allowed toward the Master's Degree, but any number toward the Doctorate.

Graduate Staff

CH 651 SPECIAL TOPICS IN CHEMISTRY **Max. 3**
Prerequisite: Graduate standing in Chemistry
Critical study of some special problems in one of the branches of Chemistry, involving original investigation together with a survey of pertinent literature.

Graduate Staff

CH 671, 672 ADVANCED PHYSICAL CHEMISTRY **3 (3-0) f s**
Prerequisite: CH 532
The work of 671 will involve a thorough review of the fundamental principles of physical chemistry with extension and application of these to the study of the solid state. In 672 there will be laid down the elements of statistical mechanics and kinetic theory, in terms of which certain topics from 671 will be more exhaustively developed. Solution of problems will play an important role in 671.

Mr. Sutton

CIVIL ENGINEERING

COURSES FOR UNDERGRADUATES

CE 201 SURVEYING I **3 (1-5) f s**
Prerequisite: MA 101
Required of sophomores in Civil Engineering, Civil Engineering Construction Option, Geological Engineering and in Landscape Architecture
Elements of plane surveying: taping, transit, level, stadia, plane table, topographic surveying and mapping, care and adjustment of instruments; public land surveys.

CE 202 SURVEYING II **3 (1-5) s**
Prerequisite: CE 201
Required of sophomores in Civil Engineering and Civil Engineering Construction Option
Construction surveys; earthwork computations; route surveys; simple, compound, parabolic and spiral curves; elementary astronomical surveying.

CE 217 FORESTRY SURVEYING **4 (2-6) s**
Prerequisite: MA 111
Required of sophomores in Forestry
Elements of plane and topographic surveying and mapping; U. S. Public Land Surveys; forestry surveying.

CE 305, 306 TRANSPORTATION ENGINEERING I, II **3 (3-2) f s**
Prerequisite: CE 202
Required of juniors in Civil Engineering
Transportation systems; elements of railroad, highway, traffic and airport engineering; physical and mechanical properties of soils that govern their use as engineering materials.

CE 321 MATERIALS TESTING LABORATORY I **2 (1-3) f s**
Prerequisite: EM 311
Required of juniors in Civil Engineering and Civil Engineering Construction Option
Properties of cementing materials, mortars, concretes, ceramic products, building stones; proportioning mortars and concretes; physical properties and performance characteristics of timber, plywood, glued construction and timber fastenings; ASTM standards.

CE 322 MATERIALS TESTING LABORATORY II **2 (1-3) f s**
Corequisite: EM 321
Required of juniors in Civil Engineering and Civil Engineering Construction Option
Properties of structural metals, riveted and welded joints; failures of materials; significance of test results; selection of working stresses; field methods for measuring load, deflection and strain.

CE 324 STRUCTURAL ANALYSIS I **3 (2-3) s**
Prerequisite: EM 311
Required of juniors in Civil Engineering and Civil Engineering Construction Option
Stress analysis of statically determinate beams and framed structures under fixed and moving loads; influence line treatment for moving loads; analysis and design of a simple truss.

CE 338 STRUCTURES I **3 (3-0) f**
Prerequisite: EM 311
Required of juniors in Architecture
Analysis of simple structures; reactions, shear and moment diagrams; stresses in members of framed structures; graphic statics.

CE 339 STRUCTURES II **3 (3-0) s**
Prerequisites: CE 338 and EM 321
Required of juniors in Architecture
Analysis of indeterminant structures; slopes and deflections; analysis of indeterminant frames by moment distribution.

CE 351 DETAILS OF BUILDING CONSTRUCTION **2 (2-0) f**
Prerequisite: Junior standing
Required of juniors in heating and air conditioning.
Structural systems with particular emphasis on location of equipment.

CE 361 ESTIMATES AND COSTS I **3 (2-3) f**
Prerequisite: Junior standing
Required of juniors in Civil Engineering Construction Option
Interpretation of working drawings; analysis of construction plans and specifications; approximate and detailed estimates of costs.

CE 362 ESTIMATES AND COSTS II **3 (2-3) s**
Prerequisite: CE 361
Required of juniors in Civil Engineering Construction Option
Preparation of complete cost estimates of construction projects; bidding procedures and preparation of bids.

CE 382 HYDRAULICS **3 (3-0) f s**
Prerequisite: EM 312
Required of juniors in Civil Engineering
Properties of fluids and mechanics of fluid flow in pipes and open channels; theory of design and characteristics of pumps and hydraulic motors; measurement of fluid flow.

CE 390 INTRODUCTION TO SANITARY ENGINEERING **1 (1-0) f s**
Prerequisite: CH 103
Elective
Survey of sanitary engineering.

COURSES FOR ADVANCED UNDERGRADUATES

CE 425 STRUCTURAL ANALYSIS II **3 (2-3) f**
Prerequisites: CE 324 and EM 321
Required of seniors in Civil Engineering
Deflection of beams and trusses; indeterminate stress analysis by moment area slope deflection and moment distribution.

CE 427 STRUCTURAL DESIGN I **4 (3-3) f**
Prerequisite: EM 321
Required of seniors in Civil Engineering and Civil Engineering Construction Option
Analysis and design of reinforced concrete building elements; design of tension, compression and simple flexural members of steel and of timber.

CE 428 STRUCTURAL DESIGN II **3 (1-6) s**
Prerequisite: CE 427
Required of seniors in Civil Engineering
Design specifications; connection details; independent and complete design of engineering structures.

CE 429 STRUCTURAL DESIGN III **3 (2-3) s**
Prerequisite: CE 427
Required of seniors in Civil Engineering Construction Option
Design of tension, compression and flexural elements of steel and timber; solution of problems in erection, forms, shoring and falsework.

CE 435 STRUCTURES III **3 (2-2) f**
Prerequisite: CE 339
Required of seniors in Architecture
Principles of steel and timber design.

CE 436 STRUCTURES IV **4 (2-4) s**
Prerequisite: CE 435
Required of seniors in Architecture
Principles of reinforced concrete design and elements of foundations.

CE 442 SOIL MECHANICS **3 (2-3) f**
Prerequisite: CE 305
Required of seniors in Civil Engineering
Fundamental stress relations, Mohr's rupture hypothesis, shearing strength, earth pressure theories, bearing capacity, stability of slopes, hydrostatics, and hydrodynamics of ground water.

CE 443 FOUNDATIONS **3 (3-0) s**
Prerequisite: CE 427
Required of seniors in Civil Engineering Construction Option
Identification and classification of soils; geological aspects of foundation engineering; method of investigating subsoil conditions; control of water; types of foundations and conditions favoring their use; legal aspects of foundation engineering.

CE 461 PROJECT PLANNING AND CONTROL I **3 (2-3) f**
Prerequisite: CE 362
Required of seniors in Civil Engineering Construction Option
Analysis of construction plant layout requirements and performance characteristics of equipment.

CE 462 PROJECT PLANNING AND CONTROL II **3 (2-3) s**
Prerequisite: CE 461
Required of seniors in Civil Engineering Construction Option
Scheduling, analysis and control of construction projects.

CE 464 LEGAL ASPECTS OF CONTRACTING **3 (3-0) s**
Prerequisite: Senior standing
Required of seniors in Civil Engineering Construction Option; elective
Legal aspects of construction contract documents and specifications; owner-engineer-contractor relationships and responsibilities; bids and contract performance; labor laws.

CE 481 HYDROLOGY AND DRAINAGE **2 (2-0) f**
Prerequisite: EM 312
Required of seniors in Civil Engineering
Occurrence and distribution of rainfall; runoff, surface and ground waters; design of drainage and control structures.

CE 482 WATER AND SEWAGE WORKS **3 (3-0) s**
Prerequisite: Senior standing
Required of seniors in Civil Engineering
Water supply analysis and design, including population estimates, consumption, source selection, adequate, distribution systems and pumping stations; elements of water treatment; collection and disposal of sewage; elements of sewage treatment.

CE 485 ELEMENTS OF HYDRAULICS AND HYDROLOGY **3 (3-0) f**
Prerequisite: EM 312
Required of seniors in Civil Engineering Construction Option
Elements of fluid mechanics, hydraulics and hydrology, with application to problems in construction engineering.

CE 492, 493 PROFESSIONAL PRACTICE I, II **1 (1-0) f s**
Prerequisite: Senior standing
Required of seniors in Civil Engineering and Civil Engineering Construction Option
Professional engineering societies and their functions; professional standards; topics of current interest to the civil engineer.

CE 497, 498 ENGINEERING CONSULTATION **2 (1-2) f s**
Prerequisite: Fifth-year standing
Required of fifth-year students in Architecture
Discussion of engineering problems in architecture.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

CE 507 AIRPHOTO ANALYSIS I **3 (2-3) f s**
Prerequisite: Junior standing
Engineering evaluation of aerial photographs, including analysis of soils and surface drainage characteristics.

CE 508 AIRPHOTO ANALYSIS II **3 (2-3) s**
Prerequisite: CE 507
Engineering evaluation of aerial photographs for highway and airport projects.

CE 510 ADVANCED SURVEYING **3 (2-3) f s**
Prerequisite: CE 202
Elements of astronomical, geodetic and photogrammetric surveying; coordinate systems and map projections.

CE 514 MUNICIPAL ENGINEERING PROJECTS **3 (2-3) s**
Prerequisite: Senior standing
Special problems relating to public works, public utilities, urban planning and city engineering.

CE 515 TRANSPORTATION ANALYSIS **3 (3-0) f**
Prerequisite: CE 306
An analysis of transportation operations and transportation facilities.

CE 516 TRANSPORTATION ENGINEERING DESIGN **3(2-3) f**
Prerequisite: CE 306
The basic elements of traffic and transportation engineering design.

CE 521, 522 ADVANCED STRUCTURAL DESIGN I, II **3 (2-3) f s**
Prerequisite: CE 425
Complete structural designs of a variety of projects; principles of limit and prestress design.

CE 524 ANALYSIS AND DESIGN OF MASONRY STRUCTURES **3 (3-0) s**
Prerequisite: CE 425
Analysis and design of arches, culverts, dams, foundations and retaining walls.

CE 531 EXPERIMENTAL STRESS ANALYSIS **3 (2-3) f**
Prerequisite: CE 425
Principles and methods of experimental analysis; dimensional analysis; applications to full-scale structures.

CE 532 STRUCTURAL LABORATORY **3 (1-6) s**
Prerequisite: CE 531
Test procedures and limitations and interpretation of experimental results.

CE 544 FOUNDATION ENGINEERING **3 (3-0) f s**
Prerequisite: CE 442
Subsoil investigations; excavations; design of sheeting and bracing systems; control of water; footing, grillage and pile foundations; caisson and cofferdam methods of construction; legal aspects of foundation engineering.

CE 547 FUNDAMENTALS OF SOIL MECHANICS **3 (3-0) f s**
Prerequisite: EM 321
Physical and mechanical properties of soils governing their use for engineering purposes; stress relations and applications to a variety of fundamental problems.

CE 548 SOIL TESTING FOR ENGINEERING PURPOSES **3 to 6 (arrange) f s**
Prerequisite: CE 442 or CE 547
Qualitative and quantitative soil testing procedures for engineering purposes.

CE 570 SANITARY MICROBIOLOGY **3 (2-3) f s**
Prerequisite: BO 312
Dynamics of disinfection and bacteriostasis; microbiology of water and sewage and of sewage treatment processes.

CE 571 THEORY OF WATER AND SEWAGE TREATMENT **3 (3-0) f**
Prerequisite: Senior Standing
Study of the physical and chemical principles underlying water and sewage treatment processes; diffusion of gases, solubility, equilibrium and ionization, anaerobic and aerobic stabilization processes, sludge conditioning and disposal.

CE 572 UNIT OPERATIONS AND PROCESS IN SANITARY ENGINEERING **3 (1-6) s**
Prerequisite: CE 571
Processes and operations in sanitary engineering; sedimentation, aeration, filtration, adsorption, coagulation, softening, sludge digestion, aerobic treatment of sewage.

CE 573 ANALYSIS OF WATER AND SEWAGE **3 (1-6) f**
Corequisite: CE 571
Chemical and physical analysis of water and sewage and interpretation of results.

CE 591, 592 CIVIL ENGINEERING SEMINAR **1 (1-0) f s**
Discussions and reports of subjects in civil engineering and allied fields.

CE 598 CIVIL ENGINEERING PROJECTS **1 to 6 (arrange) f s**
Special projects in some phases of civil engineering.

COURSES FOR GRADUATES ONLY

CE 601 TRANSPORTATION PLANNING **3 (2-3) s**
Prerequisite: CE 515
Transportation planning as related to urban planning and land usage.

CE 602 ADVANCED TRANSPORTATION ENGINEERING DESIGN **3 (2-3) s**
Prerequisite: CE 516
Corequisite: CE 601
The planning and design of major traffic and transportation engineering projects.

CE 603 AIRPORT PLANNING AND DESIGN **3 (2-3) s**
Prerequisite: CE 515
Corequisite: CE 601
The analysis, planning and design of air transportation facilities.

CE 604 URBAN PLANNING AND MASS TRANSPORTATION **3 to 6 (arrange) s**
Prerequisite: CE 515
Corequisite: CE 601
The analysis, planning and design of mass transportation facilities.

CE 621, 622 ADVANCED STRUCTURAL ANALYSIS I, II **3 (3-0) f s**
Prerequisite: CE 425
Analysis of rigid frames and continuous structures; treatment of redundant members and secondary stresses.

CE 624 THEORY AND DESIGN OF ARCHES, THIN SHELLS AND DOMES **3 (3-0) s**
Prerequisite: CE 621
Corequisite: EM 602
Analysis and design of hinged and rigid arches of both frame and rib construction; and of thin shells and domes.

CE 626 STRUCTURAL CONNECTIONS **3 (3-0) s**
Prerequisite: CE 621
Analysis of stresses in simple, rigid and semi-rigid connections; critical review of specifications.

CE 641, 642 ADVANCED SOIL MECHANICS **3 (3-0) f s**
Prerequisite: CE 442 or
Corequisite: CE 547
Theories of soil mechanics; failure conditions; mechanical interaction between solids and water, and problems in elasticity pertaining to earthwork engineering.

CE 643 HYDRAULICS OF GROUND WATER **3 (3-0) f s**
Prerequisite: CE 442 or 547
Principles of ground water hydraulics; theory of flow through idealized porous media; the flow net solution; seepage and well problems.

CE 671 ADVANCED WATER SUPPLY AND SEWERAGE **4 (3-3) f**
Prerequisite: CE 482
Problems relating to the design of water supply and sewerage works.

CE 672 ADVANCED WATER AND SEWAGE TREATMENT **4 (3-3) s**
Prerequisite: CE 482
Problems relating to the treatment of water and sewage.

CE 673 INDUSTRIAL WATER SUPPLY AND WASTE DISPOSAL **3 (3-0) f s**
Corequisite: CE 571
Water requirements of industry and the disposal of industrial wastes.

CE 674 STREAM SANITATION **3 (3-0) f s**
Corequisite: CE 571
Biological, chemical and hydrological factors that affect stream sanitation and stream use.

CE 698 CIVIL ENGINEERING RESEARCH **1-6 (arrange) f s**
Independent investigation of an advanced civil engineering problem; a report of such an investigation is required as a graduate thesis.

DAIRY MANUFACTURING (ANIMAL INDUSTRY) – — — —

COURSES FOR UNDERGRADUATES

DM 400 PLANT EXPERIENCE **Maximum 6**
Prerequisite: Approval of adviser
Practice in processing dairy products, including milk, ice cream, cheese, butter and concentrated milks; application of laboratory control; and practice in dairy equipment maintenance. Required of all Dairy Manufacturing majors, unless proof of equivalent experience can be shown.

Staff

DM 401 MARKET MILK AND RELATED PRODUCTS **3 (2-3) s**
Prerequisite: Approval of instructor
Principles and information on the production, processing, distribution and public health control of fluid milk and related products.

Mr. Roberts

DM 402 CHEESE **3 (2-3) s**
Prerequisite: Approval of instructor
Principles and practice in the manufacture and curing of various types of cheese; importance and propagation of cheese starters.

Mr. Warren

DM 403 ICE CREAM AND RELATED FROZEN DAIRY FOODS **3 (2-3) f**
Prerequisite: Approval of instructor
Choice, preparation and processing of ingredients and freezing of ice cream and other frozen desserts.

Mr. Warren

DM 404 BUTTER AND DAIRY BY-PRODUCTS **3 (2-3) s**
Prerequisite: Approval of instructor
A study of the fundamentals of buttermaking, and the principles of manufacturing concentrated and dried milks.

Mr. Warren

DM 405 DAIRY MECHANICS **1 (0-3) f**
Prerequisite: Approval of Instructor
Laboratory practice in the operation and maintenance of dairy plant equipment and refrigeration systems; malfunctions of electrical systems; installation of sanitary milk lines and water lines.

Mr. Blanton

DM 406 JUDGING DAIRY PRODUCTS **1 (0-3) s**
Prerequisite: Approval of instructor
Milk and dairy products judging according to official standards and commercial grades.

Mr. Warren

DM 407 DAIRY BACTERIOLOGY I **4 (2-4) f**
Prerequisite: BO 312
Applications of the principles of bacteriology to the production of quality milk and maintenance of quality in processing milk and milk products; various desirable and undesirable activities of bacteria in milk; methods of enumerating bacteria; detecting certain groups of bacteria of particular importance; and the relationships of bacteria in milk to public health.

Mr. Speck

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

DM 501 ADVANCED DAIRY TECHNOLOGY **3 (1-6) f**
Prerequisite: DM 401
The functions and operations of a dairy control laboratory; a comprehensive study of methods of analyses of dairy products and related non-dairy products; the application and interpretations of methods for quality and composition control of dairy products.

Mr. Warren

DM 504 DAIRY PLANT MANAGEMENT **4 (3-2) s**
Prerequisite: DM 401
Business and factory management practices as use din the dairy plant.

Mr. Roberts

DM 506 DAIRY BACTERIOLOGY II **3 (0-6) s**
Prerequisite: DM 407, or equivalent
A detailed study of bacteria particularly involved in the dairy industry regarding their physiology, morphology and cultural characteristics with application to practical dairy farm and plant problems.

Mr. Speck

DM 508 DAIRY CHEMISTRY **3 (1-4) f**
Prerequisite: CH 103 or 203, DM 401
A qualitative study of the physical, colloidal and chemical properties of milk and its constituents.

Mr. Aurand

COURSES FOR GRADUATES ONLY

DM 601 SEMINAR IN DAIRY MANUFACTURING **1 (1-0) f s**
1 credit per term

Prerequisite: Graduate standing in Dairy Manufacturing
Scientific articles, process reports in research and special problems of interest are reviewed and discussed. A maximum of two credits is allowed toward the Master's degree, but any number toward the Doctorate.

Graduate Staff

DM 602 ADVANCED DAIRY CHEMISTRY **4 f s**
Prerequisite: DM 508
A quantitative study of the physical, colloidal and chemical properties of milk and its constituents.

Mr. Aurand

DM 603 ADVANCED DAIRY BACTERIOLOGY **4 f s**
Prerequisite: DM 506
Industrial fermentations used or applicable in the utilization of surplus milk and milk products. The student conducts various fermentations and makes the requisite chemical and biological measurements in order to determine yields and efficiency of the process.

Mr. Speck

DM 604 TOPICAL PROBLEMS IN DAIRY MANUFACTURING **1 to 3 credits per term**
Prerequisite: Graduate standing in Dairy Manufacturing
Special problems in various phases of dairy manufacturing. A maximum of six credits is allowed.

Graduate Staff

DM 605 RESEARCH IN DAIRY MANUFACTURING **Credits by arrangement**
Prerequisite: Graduate standing in Dairy Manufacturing
A maximum of six credits is allowed toward the Master's Degree; no limitation on credits in Doctorate programs.

Graduate Staff

DESIGN

COURSES FOR UNDERGRADUATES

DN 101, 102 DESIGN I, II **3 (3-6) f s**
Required of all first year students in the School of Design
Introduction to the elements and expression of two and three dimensional design involving a variety of tools, materials, and techniques. Orientation of historical and contemporary concepts of art and architecture.

Messrs. Gussow, Hertzman

DN 111, 112 DESCRIPTIVE DRAWING I, II **2 (0-4) f s**
Required of all first year students in the School of Design
Problems in analysis of visual perception with emphasis placed on the various systems man has developed to reduce visual experience into a two dimensional frame of reference. Freehand studies from nature as a means of studying drawing methods.

Messrs. Sengupta, Taylor

DN 201, 202 DESIGN III, IV **4 (3-6) f, 5 (3-6) s**
Prerequisite: DN 102
Required of all second year students in the School of Design
The design sequence for this year seeks the solutions of problems which will tax the student's imaginative powers without making unreasonable demands on his newly gained technical abilities. Emphasis is placed on the architectural application of more general design principles to which the student has been previously exposed.

Messrs. Buisson, Waugh

DN 211, 212 DESCRIPTIVE DRAWING III, IV **2 (0-4) f s**
Prerequisite: DN 112
Required of all second year students in the School of Design
Problems involving both analysis and synthesis whereby the student continues with the studies begun in the freshman year with the added element of learning to create images of possible visual experience wholly from imaginative process.

Mr. Cox

DN 311, 312 DESCRIPTIVE DRAWING V, VI **2 (0-6) f s**
Prerequisite: DN 212
Required of all third year students in the School of Design
Problems involving the creative aspects of drawing, graphic arts, painting and sculpture. Type of classwork varies with instructor.

Messrs. Bireline, Cox

DN 331, 332 HISTORY OF DESIGN I, II **3 (3-0) f s**
Prerequisite: DN 102
Required of all third year students in the School of Design
A critical study of the civilization of historic people and their contributions in the field of Design, (from ancient through medieval times), related to architecture, landscape architecture and visual aids.

Messrs. Elliott, Buisson

DN 411, 412 DESCRIPTIVE DRAWING VII, VIII **2 (0-6) f s**
Prerequisite: DN 312
Required of all fourth year students in the School of Design
Continuation, at a more complex level, of work begun in third year.

Mr. Gussow

DN 422, 521 OFFICE PROCEDURE I, II **2 (2-0) s f**
Prerequisite: ARC 302
Required of all fourth and fifth year students in the School of Design
A study of the ethics, organization, and procedures of professional architectural practice; specifications, estimates and building codes.

Mr. Waugh

DN 431, 432 HISTORY OF DESIGN III, IV **3 (3-0) f s**
Prerequisite: DN 332
Required of all fourth year students in the School of Design
A continuation of the course DN 332 from the Renaissance Period through the Age of Reason till the Middle of the XIX Century.

Messrs. Buisson, Clarke

DN 511, 512 DESCRIPTIVE DRAWING IX, X **2 (0-6) f s**
Prerequisite: DN 412
Required of all fifth year students in the School of Design
Continuation of third and fourth year work into "thesis" type activities wherein more mature projects may be undertaken.
Mr. Stuart

DN 531 HISTORY OF DESIGN V **3 (3-0) f**
Prerequisite: DN 432
Required of all fifth year students in the School of Design
A critical study of the modern life and design in relation to social and cultural conditions, based on the spirit of the XIX and XX Centuries.
Mr. Elliott

DN 541, 542 PHILOSOPHY OF DESIGN I, II **2 (2-0) f s**
Prerequisite: ARC 402
Required of all fifth year students in the School of Design
An introduction to aesthetics and the relationships of philosophic thought to design.
Mr. Kamphoefner and Visiting Professors

ECONOMICS

EC 201, 202 ECONOMICS **3 (3-0) f s**
Fundamental principles applying to the organization and functioning of our economy.

EC 205 THE ECONOMIC PROCESS **3 (3-0) f s**
An analysis of the process and principles by which an economy allocates resources, distributes goods and income and determines rate of growth.

EC 305 BUSINESS ORGANIZATION **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
A survey of business organization, operation, and practices. Special emphasis is given to the forms of business enterprises, principles of management, and the relation of the business unit to the economic system.

EC 312 ACCOUNTING FOR ENGINEERS **3 (3-0) f s**
A survey of accounting principles; the analysis and recording of business transactions; financial statements, their construction, use and interpretation.

EC 315 SALESMANSHIP **2 (2-0) f s**
An introduction to the principles and techniques of selling from the standpoint of the individual salesman. A course designed for the technical student anticipating entering the field of distribution.

EC 319 MONEY AND BANKING **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school.
A study of the role of money in the economic organization; methods of stabilizing the price level; study of the proper organization and functioning of commercial banking and the Federal Reserve System; the problems of monetary standards and credit controls; recent monetary and banking trends are emphasized.

EC 350 ECONOMIC GEOGRAPHY **3 (3-0) s**
A study of world resources and industries and their relationship to trade and manufacturing. Distribution of the principal commodities of world commerce. An analysis of the world's important agricultural, industrial and commercial regions.

EC 401, 402 PRINCIPLES OF ACCOUNTING **3 (2-2) f s**
Fundamental principles of accounting theory and practice; the analysis and recording of business transactions; explanation and interpretation of the structure, forms and use of financial statements.

EC 407 BUSINESS LAW I **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
A course dealing with elementary legal concepts, contracts, agency, negotiable instruments, sales of personal property, chattel mortgages, portnerships, corporations suretyship and bailments, insurance.

EC 408 BUSINESS LAW II **3 (3-0) f s**
Prerequisite: EC 407
Deals with real property, mortgages on urban and farm lands, landlord and tenant, requirements for valid deed, insurance law, wills, suretyship and conditional sales.

EC 409 CONSTRUCTION ACCOUNTING **3 (2-2) f s**
Prerequisite: EC 312
An introduction to the accounting problems peculiar to a construction organization. An analysis of the problems of estimating and allocating the costs of materials, labor and overhead to individual jobs.

EC 411 MARKETING METHODS **3 (3-0) f**
Prerequisite: The basic course in Economics required by the degree-granting school.
Marketing institutions and their functions and agencies; retailing; market analysis; problems in marketing.

EC 412 SALES MANAGEMENT **3 (3-0) s**
Prerequisite: EC 411
Elements of sales management with emphasis on planning, operations, policies and programs.

EC 414 TAX ACCOUNTING **3 (2-2) f s**
Prerequisite: EC 312 or EC 401
An analysis of the Federal tax laws relating to the individual and business. Determining and reporting income. Payroll taxes and methods of reporting them. Actual practice in the preparation of income tax returns.

EC 415 ADVERTISING **2 (2-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
Principles of advertising; purposes; preparation of copy; media; advertising campaigns; legislation.

EC 420 CORPORATION FINANCE **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
Financial instruments and capital structure; procuring funds; managing working capital; managing corporate capitalization; financial institutions and their work.

EC 425 INDUSTRIAL MANAGEMENT **3 (3-0) f**
Prerequisite: Junior standing; Sophomore standing for furniture manufacturing and management students.
Principles and techniques of modern scientific management; relation of finance, marketing, industrial relations, accounting, and statistics to production; production planning and control; analysis of economic, political and social influences on production.

EC 426 PERSONNEL MANAGEMENT **3 (3-0) s**
Prerequisite: Junior standing
The scientific management of manpower, from the viewpoint of the supervisor and the personnel specialist. A study of personnel policy and a review of the scientific techniques regarding the specific problems of employment, training, promotion, transfer, health and safety, employee service, and joint relations.

EC 431 LABOR PROBLEMS **3 (3-0) f s**
Prerequisite: Junior standing
An economic approach to labor problems including wages, hours, working conditions, insecurity, substandard workers, minority groups, social security, and public policy relative to these problems.

EC 432 INDUSTRIAL RELATIONS **3 (3-0) f s**
Prerequisite: Junior standing
Collective bargaining. Analysis of basic labor law and its interpretation by the courts and governmental agencies. An examination of specific terms of labor contracts and their implications for labor and management. An examination of labor objectives and tactics and management objectives and tactics. Problems of operating under the labor contract.

EC 436 ECONOMIC FLUCTUATIONS **2 (2-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
An empirical and theoretical analysis of changes in the level of economic activity. These changes will be examined as to causes, extent and timing, and effects.

EC 442 EVOLUTION OF ECONOMIC IDEAS **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
An analysis of the development of economic thought and method during the past two centuries. Economics considered as a cumulative body of knowledge, in a context of emerging technology, changing institutions, pressing new problems, and the growth of science.

EC 444 ECONOMIC SYSTEMS **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
A comparative analysis of the functioning of the major economic systems, with emphasis upon the ways in which the problem of economic calculation is approached in a variety of institutional settings.

EC 461 (HI 461 or PS 461) THE SOVIET UNION **3 (3-0) f**
Prerequisites: One semester of Economics and PS 201 or HI 205 or acceptable substitute
An analysis of the structure and function of the major Soviet economic, political and social institutions with special stress on the historical roots and continuity of Russian civilization. The course is presented in three equal phases of approximately five weeks each, covering Russian history, Soviet government and Soviet economy.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EC 501 INTERMEDIATE ECONOMIC THEORY **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
A systematic theoretical treatment of the functioning of a modern economy with special emphasis upon the pricing system.

Messrs. Allen, Shen

EC 502 MONEY, INCOME, AND EMPLOYMENT **3 (3-0) s**
Prerequisite: The basic course in Economics required by the degree-granting school
A study of the methods and concepts of national income analysis with particular reference to the role of monetary policy in maintaining full employment without inflation.

Messrs. Allen, Olsen

EC 503 ADVANCED ACCOUNTING **3 (2-2) f s**
Prerequisites: The basic course in Economics required by the degree-granting school, and EC 401, 402
Problems of asset valuation, such as depreciation, replacements, amortization, etc., as found in all types of business organizations: branch accounting, consolidations, installment selling.

Messrs. Fails, Shulenberger

EC 504, 505 PRINCIPLES OF COST ACCOUNTING **3 (2-2) f s**
Prerequisites: The basic course in Economics required by the degree-granting school, and EC 401, 402
Cost finding, materials costs, labor costs, overhead costs, etc., with an introduction to standard cost procedures.

Mr. Shulenberger

EC 510 PUBLIC FINANCE **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
A study of fiscal policy and analysis of the fiscal devices of government, including expenditure, taxation, and borrowing.

EC 514 INTERNATIONAL ECONOMICS **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
An analysis of international economic relations including trade, investment, and the payments problem, with continuing consideration of policy.

EC 515 INVESTMENTS **3 (3-0) s**
Prerequisite: The basic course in Economics required by the degree-granting school
Types of investment; investment market; investment analysis; investment channels; investment fluctuations; investment policies and practices.

Mr. Moen

EC 518 PRINCIPLES OF INSURANCE **2 (2-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
Risk as an element of all agricultural and industrial activity; discussion of such risks as can be covered by insurance with the appropriate forms of insurance, e.g., employer's liability, workmen's compensation, fire, life, and other forms.

Mr. Shulenberger

EC 519 MONETARY THEORY **3 (3-0) f s**
Prerequisites EC 319 or EC 502
Prerequisite: The basic course in Economics required by the degree-granting school
A study of the forces determining the value of money; the role of money in economic growth and in the maintenance of economic stability; and a consideration of monetary policy.

Mr. Olsen

EC 521 OFFICE MANAGEMENT **3 (3-0) f s**
Prerequisite: Open to seniors and graduate students only
The application of scientific management principles to office problems including: office planning and layout, equipment, filing, correspondence, selection, training and supervision of office employees, promotions and wage increases, office costs and budgets.

Mr. Fails

EC 525 SEMINAR IN SPECIAL ECONOMIC TOPICS **Max 6**
Prerequisite: Graduate standing or consent of the instructor
Topics presented by a special lecturer. This course will be offered from time to time as distinguished visiting scholars are available.

EC 531 MANAGEMENT OF INDUSTRIAL RELATIONS **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
A seminar course designed to round out the technical student's program. Includes a survey of the labor movement organization and structure of unions, labor law and public policy, the union contract, the bargaining process, and current trends and tendencies in the field of collective bargaining.

Messrs. Bartley, Wood

EC 540 ECONOMIC GROWTH AND DEVELOPMENT **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
An introduction to the theory of economic growth and development, with special application to the presently under-developed areas of the world.

Mr. Olsen

EC 548 ECONOMICS OF WELFARE **3 (3-0) f s**
Prerequisite: The basic course in Economics required by the degree-granting school
An analysis of the efficiency of our economy, including resource allocation, rate of growth, degree of stability, and income distribution

EC 550 MATHEMATICAL MODELS IN ECONOMICS **3 (3-0) f s**
Prerequisites: The basic course in Economics required by the degree-granting school, MA 202 or 212, and consent of the instructor
An introductory study of economic models emphasizing their formal properties. The theory of individual economic units is presented as a special case of 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.

Mr. Harrell

EC 555 INTRODUCTION TO LINEAR PROGRAMMING **3 (3-0) f s**
Prerequisites: The basic course in Economics required by the degree-granting school, and consent of the instructor
Recent developments in the theory of production, allocation and organization. Optional combination of integrated productive processes within the firm. Applications in the economics of industry and of agriculture.

Mr. Harrell

COURSES FOR GRADUATES ONLY

EC 601 ADVANCED ECONOMIC THEORY **3 (3-0) f s**
Prerequisite: EC 501
A rigorous examination of contemporary economic theory, with special regard to such fields as general equilibrium theory, growth theory and organization theory.

Mr. Hickman

EC 603 HISTORY OF ECONOMIC THOUGHT **3 (3-0) s**
Prerequisite: EC 442 or EC 501
A systematic analysis of the development and cumulation of economic thought, designed in part to provide a sharper focus and more adequate perspective for the understanding of contemporary economics.

Messrs. Hickman, Olsen

EC 605 RESEARCH IN ECONOMICS **Arranged**
Prerequisite: Graduate standing
Individual research in economics, under staff supervision and direction.

EC 655 SPECIAL TOPICS IN PROGRAMMING **3 (3-0) f s**
Prerequisites: The basic course in Economics required by the degree-granting school, MA 202, MA 403, or EC 555 and consent of the instructor.
A lecture and research course devoted to recent literature in programming theory and its applications.

Mr. Harrell

EDUCATION

AGRICULTURAL EDUCATION
See pages 173-174 for ED 101; 102; 201; 313; 411; 412; 413; 430; 554; 558; 563; 568; 616; 617; 618; 621; 664.

INDUSTRIAL ARTS AND INDUSTRIAL EDUCATION
See pages 233-237 for IA 100; 103; 104; 107; 108; 203; 205; 206; 207; 215; 230; 304; 306; 307; 308; 314; 315; 320; 321; 460; 510; 570; 575; 580; ED 100; 422; 440; 444; 482; 483; 516; 521; 525; 527; 528; 552; 595; 610; 614; 619; 624; 627; 630; 635.

INDUSTRIAL AND RURAL RECREATION
See pages 229-233.

GENERAL COURSES

ED 308 VISUAL AIDS **2 (1-2) s**
Methods and techniques of visual instruction; lettering; statistical illustration; chart, graph and poster-making; photography; projector operation, care and use.
Mr. Armstrong

ED 344 SECONDARY EDUCATION **2 (1-2) f s**
An overview of secondary education, including development, problems, services, trends, teaching profession, role of school in the community, purposes and objectives. The development and status of secondary education in North Carolina is taken up.
Mr. Morehead

ED 410 DRIVER EDUCATION **3 (2-2) s**
Course offered during Summer session only
The principles of teaching the basic driving skills, including the new concept of defensive driving, observance and interpretation of motor vehicle laws, adverse driving conditions, handling of accident situations and care of the car.

MATHEMATICS AND SCIENCE EDUCATION
See pages 244-245 for ED 203; 470; 471; 475; 476.

OCCUPATIONAL INFORMATION AND GUIDANCE
See pages 255-256 for ED 420; 424; 524; 530; 531; 532; 590; 631; 633; 641; 651.

PSYCHOLOGY
See pages 266-269.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 501 EDUCATION OF EXCEPTIONAL CHILDREN **3 (2-2) f**
Prerequisite: Six hours in education or psychology
Advanced undergraduates or graduates
Discussion of principles and techniques of teaching the exceptional child with major interest on the mentally handicapped and slow learner. Practice will be given in curriculum instruction for groups of children, individual techniques for dealing with retarded children in the average classroom. Opportunity for individual work with an exceptional child will be provided.
Mr. Corter

ED 502 ANALYSIS OF READING ABILITIES **3 (3-0) f**
Prerequisites: Six hours in education or psychology
A study of tests and techniques in determining specific abilities; a study of reading retardation and factors underlying reading difficulties
Mr. Rust

ED 503 IMPROVEMENT OF READING ABILITIES **3 (3-0) s**
Prerequisite: Six hours in education or psychology
A study of methods used in developing specific reading skills or in overcoming certain reading difficulties; a study of methods used in developing pupil vocabularies and word analysis skills; a study of how to control vocabulary burden of reading material.
Mr. Rust

ED 505 GROUP DYNAMICS IN TEACHING **3 (Summer only)**
Prerequisite: Six hours in education or psychology
A study of group methods in teaching with special reference to role playing, conference techniques and group dynamics in their application to teaching and an understanding of the student's behavior.
Mr. Miller

ED 509 WORKSHOP IN SPECIAL EDUCATION **3-6 (1-4) s**
Prerequisite: Three hours in special education and a teaching certificate
The workshop in special education combines a practicum in special education with work on individual projects in a workshop situation. Wide latitude is given to teachers to work in areas of special interests or need. In addition to usual group meetings, materials are collected in handbook form each year for teachers' use.
Mr. Corter

ED 510 ADVANCED DRIVER EDUCATION **3 (2-2) s**
The study of course content in present day driver education courses: Evaluation of research literature in driver education; a study of existing driver education programs at both secondary and college levels; and evaluation of psychological and educational research in accidents.

ED 552 INDUSTRIAL ARTS IN THE ELEMENTARY SCHOOL **3 (Summer)**
Prerequisites: Twelve credits in education and consent of instructor
This course is organized to help elementary teachers and principals understand how tools and materials and industrial processes may be used to vitalize and supplement the elementary school children's experiences. Practical children's projects along with the building of classroom equipment.

Mr. Hostetler

ED 615 INTRODUCTION TO EDUCATIONAL RESEARCH **3 (3-0) f**
Prerequisite: Six hours in education or psychology
An introductory course for students preparing for an advanced degree. The purposes are: to assist the student in understanding the meaning and purpose of educational research and the research approach to problems; to develop students' ability to identify educational problems, and to plan and carry out research to solve these problems; to aid in the preparation of the research report. Special attention is given to tools and methods of research. Consideration is also given to the educator as a consumer of research.

Mr. Morehead

ED 665 SUPERVISING STUDENT TEACHING **3 (3-0) f s**
Prerequisites: ED 411, 563, 610 or equivalent
A study of the program of student teaching in teacher education. Special consideration will be given the role of the supervising teacher, including the following areas: Planning for effective student teaching, observation and orientation, school community study, analysis of situation, evaluating student teacher, and coordination with State College.

Graduate Staff

ELECTRICAL ENGINEERING

COURSES FOR UNDERGRADUATES

EE 201 ELEMENTARY CIRCUITS AND FIELDS **4 (2-5) f s**
Corequisite: MA 201
Required of sophomores in EE
Fundamental laws of electric circuits and magnetic circuits. Problem drill and laboratory exercises.

Staff

EE 202 ELEMENTARY CIRCUITS AND FIELDS **4 (2-5) s**
Prerequisite: EE 201, MA 201
Required of sophomores in EE
A continuation of EE 201. Introduction to simple circuit transients and steady-state alternating-current circuit theory. Fundamental laws of magnetic fields and electric fields. Problem drill and laboratory exercises.

Staff

EE 301, 302 INTERMEDIATE CIRCUITS AND FIELDS **4 (2-5) f**
3 (2-2) s
Prerequisite: EE 202, PY 202, MA 202
Required of Juniors in EE
An intermediate treatment of lumped-constant alternating-current circuits in the steady state. Single- and three-phase circuits. Discussion of electric and magnetic fields, distributed constants and traveling waves. The theory of transmission lines at power and audio frequencies. Filters and impedance matching. One three-hour laboratory per week is included in the first semester.

Staff

EE 305, 306 ELECTRICAL MACHINERY **4 (2-5) f s**
Prerequisites: EE 202 for EE 305; EE 301 for EE 306
Required of Juniors in EE
A classroom and laboratory study of the principles, performance and characteristics of direct current and alternating current machinery.

Staff

EE 310 ILLUMINATION **3 (2-3) f**
Prerequisites: EE 301 or EE 320 or EE 331
A classroom and laboratory study of the principles involved in the production and utilization of light from artificial sources; a study of the requirements for good lighting; and design of lighting installations for schools and industry. Two hours recitation and one three-hour laboratory or problem period per week.

Mr. Winkler

EE 320 ELEMENTS OF ELECTRICAL ENGINEERING **4 (3-3) f s**
Prerequisites: MA 202, PY 202
Required of seniors in MEA, AGE, MIC, CHE, MIG, IE, CE and NE
Principles, characteristics and operation of electric equipment and systems. Theory and problems in applied electricity; motor characteristics and industrial applications. Three hours of lecture and one three-hour laboratory or recitation per week.

Staff

EE 331, 332 PRINCIPLES OF ELECTRICAL ENGINEERING **4 (3-3) f s**
Prerequisites: MA 202, PY 202
Required of seniors in EPY and ME
Basic concepts, electrical power generation and utilization circuit elements, single and polyphase a.c. circuits, transformers, rotating electrical machines. Fundamentals of Electronics and control circuits. Three hours of lecture and one three-hour recitation or laboratory per week.

Staff

EE 341, 342 INDUSTRIAL ELECTRICITY **4 (3-2) f s**
Prerequisites: PY 211, 212
Required of juniors in Heating and Air Conditioning curriculum.
A study of the basic electric circuits and machinery with emphasis on single phase and three phase power and energy relations, the performance, maintenance and applications of motors and transformers; motor control; rules for wiring as specified by the National Electric Code. (Three hours work lecture and three hours work recitation or laboratory per week.)

Staff

EE 350 ELECTRICAL APPLICATIONS IN WOOD PRODUCTS MANUFACTURING **3 (2-3)**
Prerequisites: PY 211, 212
Required of juniors in Pulp and Paper Technology curriculum
Optional for juniors or seniors in Furniture Manufacturing and Management
A study of electrical power applications in the pulp and paper industries, and in furniture manufacturing. Includes a.c. and d.c. circuits; single phase and polyphase power and energy measurements; d.c. and a.c. motors; and control systems. Two hours recitation and one three-hour laboratory or problem per week.

Staff

COURSES FOR ADVANCED UNDERGRADUATES

EE 411, 412 ELECTRICAL ENGINEERING SENIOR SEMINAR **1 (0-2) f s**
Prerequisite: Senior standing
Required of seniors in Electrical Engineering
Weekly meetings for the delivery and discussion of student papers on topics of current interest in Electrical Engineering.

Staff

EE 414 ELECTRON TUBES **4 (3-3) s**
Prerequisites: EE 301, MA 202
Required of juniors in EE
A study of the fundamentals of electrical conduction in vacuum and gases. Operating characteristics of vacuum and gaseous tubes, mercury arc retifiers, photoelectric cells, cathoderay oscilloscopes, etc. Introduction to vacuum tube circuit theory. One laboratory period a week illustrates the theory covered during lecture and recitation periods.

Staff

EE 430 ESSENTIALS OF ELECTRICAL ENGINEERING **4-0**
Prerequisites: MA 401, EE 332 or equivalent
Not available to undergraduates in electrical engineering
Essential theory of electric circuits, including electron tubes, solid state devices, transformers and rotating machines as needed to supply the electrical background for instrumentation and control theory. Intended primarily for graduate students who do not have an electrical engineering undergraduate degree.

Mr. Hoadley and Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EE 501, 502 ADVANCED ELECTRIC CIRCUITS AND FIELDS **3 (2-2) f s**
Prerequisite: EE 302, MA 401
Required of seniors in EE
A continuation of the study of electric circuits and fields. Consideration of the transient state in electrical circuits, transformation techniques for the solution of problems. Application of classical electric and magnetic field theory to the problems of electrical engineering, using vector analysis.

Mr. Stevenson

EE 510 HIGH VOLTAGE LABORATORY **1 (0-3) f s**
Prerequisites: EE 302, PY 401
A laboratory course of the techniques of producing and handling high voltages. Corona, surface discharge, breakdown and other phenomena are studied. Typical high voltage tests are performed on dielectrics.

EE 511, 512 ELECTRIC COMMUNICATIONS **4 (3-3) f s**
Prerequisites: EE 302, 414
A classroom and laboratory study of the circuits and equipment involved in radio and wire communication: circuit elements, vacuum tube and transistor and oscillators, modulation, detection, antennas and radio propagation. Emphasis is on design and quantitative analysis.

Mr. Barclay

ELECTRICAL ENGINEERING

EE 513, 514 ELECTRIC POWER ENGINEERING **4 (3-3) f s**
Prerequisite: EE 302
Long distance transmission of power. Line parameters by the method of geometric mean distances. Circle diagrams, symmetrical components and fault calculations. Elementary concepts of power system stability. Prime movers, bus systems and switchgear. Loads and the selection of motors for various industrial applications. One three-hour laboratory per week accompanies the classroom study.

Messrs. Hoadley, Stevenson

EE 515 INDUSTRIAL ELECTRONICS AND CONTROL **4 (3-3) f**
Prerequisites: EE 306, 414
A study, with laboratory tests, of the application of electronic devices to industrial processes and equipment outside of the field of communications. Speed and voltage control; timing devices; electronics heating; air purification; production and quality control; photo electric devices.

Messrs. Goetze, Hoadley

EE 516 FUNDAMENTALS OF SERVOMECHANISMS **4 (3-3) s**
Prerequisites: MA 401, and either EE 302 or 332
Dynamics and synthesis of closed-loop control systems using transient and sinusoidal analyses. Applications to electrical, mechanical and chemical systems. One two-hour laboratory or problem period per week to supplement the classroom work.

Messrs. Goetze, Hoadley

EE 518 INSTRUMENTATION AND CONTROL IN NUCLEAR TECHNOLOGY **0-4**
Prerequisites: EE 430; or EE 301, EE 305, EE 414; and MA 401
Radiation detectors, pulse amplifiers, pulse shapers, amplitude discriminators, counters, coincidence circuits, reactor kinetics, reactor simulators, automatic control of reactors.

Mr. Hoadley and Staff

COURSES FOR GRADUATES ONLY

EE 605, 606 ELECTRICAL ENGINEERING SEMINAR **1 (1-0) f s**
Prerequisite: Graduate standing in EE
A series of papers and conferences participated in by the instructional staff, invited guests and students who are candidates for advanced degrees.

Graduate Staff

EE 611, 612 COMMUNICATION NETWORKS **4 (4-0) f s**
Prerequisites: EE 302, 501
Steady state and transient performance of the generalized network. Analysis and synthesis of two-and four-terminal reactive networks. Wave filters and phase equalizers. Networks containing resistances and reactances. Feedback systems, such as feedback amplifiers, regulators and servomechanisms. The study includes both the analysis and the synthesis of such systems, in terms of transient and steady-state response, using mathematical methods based on the theory of the complex variable.

Messrs. Hoadley, Tompkins

EE 615 ELECTROMAGNETIC WAVES **4 (3-3) f**
Prerequisite: EE 502
Maxwell's Equations applied to a study of the propagation of energy by electromagnetic waves. Vector and scalar potentials, retarded potentials, reflection and refraction power flow and energy density; plane rectangular and cylindrical wave guides; lines and cavity resonators. Laboratory on microwave techniques and measurements.

Messrs. Barclay, Tompkins

EE 616 ADVANCED RADIO ENGINEERING **4 (3-3) s**
Prerequisites: EE 512, 615
Analysis and design of microwave transmitting, receiving and measuring systems. Electronic methods of pulsing, timing, counting, gating and computing with applications to communication, navigation, radar and computer systems. Theory and application of klystrons, magnetrons and traveling-wave tubes. Laboratory emphasizes non-sinusoidal electronic circuitry.

Mr. Barclay

EE 618 RADIATION AND ANTENNAS **4 (3-3) f**
Prerequisite: EE 615
Electromagnetic wave theory applied to antennas and antenna rays. Calculation and measurement of directional characteristics and field intensity.

Mr. Barclay

EE 621 VACUUM TUBE DESIGN **3 (3-0) f**
Prerequisite: EE 512, 615 and MA 611
An intensive analytic study of the laws of electron emission and motion and the design of vacuum tubes. Poisson's equation and conformal transformations are used to develop design criteria and equations. Analytic and experimental methods for determining potential fields are studied. Construction and high vacuum practice are covered.

Mr. Barclay

EE 622 ELECTRON OPTICS AND TRANSIT TIME EFFECTS **4 (3-3) s**
Prerequisite: EE 621
The equivalent noise generator circuit is applied to the various sources of noise in vacuum tubes. Electrostatic and magnetic lens action. Transit time in high frequency tubes and velocity modulated tubes, magnetrons, cathode ray and photoelectric tubes.

Mr. Barclay

EE 631 ADVANCED ALTERNATING-CURRENT MACHINERY **3 (3-0) s**
Prerequisite: EE 306
An advanced study of transformers and rotating a-c machines. Design considerations, harmonics, transient behavior, equivalent circuits.

Mr. Hoadley

EE 632 ADVANCED ELECTRICAL MACHINERY **3 (3-0) f**
Prerequisite: EE 306
An intensive study of commutator machines, adjustable speed drives, special machines and magnetic amplifier circuits.

Mr. Hoadley

EE 635, 636 DIELECTRIC THEORY AND HIGH VOLTAGE ENGINEERING **3 (3-0) f s**
Prerequisite: EE 414
High Voltage measurement methods, theory and experimental investigations of dielectric properties of insulating materials (gases, liquids, solids). Problems involved with technical applications (design of insulators, corona losses of high voltage lines, circuit breaker theory).

EE 637 CIRCUIT ANALYSIS OF POWER SYSTEMS **3 (3-0) s**
Prerequisite: EE 514
An advanced treatment of symmetrical components applied to unsymmetrical faults, unsymmetrical systems, and simultaneous faults.

Mr. Stevenson

EE 638 POWER SYSTEM STABILITY **3 (3-0) f**
Prerequisite: EE 514
A study of the principal factors affecting stability and of the method of making stability calculations. Illustrations of studies made on actual power systems.

Mr. Stevenson

EE 643 ADVANCED ELECTRICAL MEASUREMENTS **2 (2-0) f**
Prerequisites: EE 302, 414
A critical analysis of circuits used in electrical measurements, with special attention to such topics as balance convergence, effects of strays, sensitivity and use of feedback in electronic devices.

Mr. Hoadley

EE 645, 646 ADVANCED ELECTROMAGNETIC THEORY **3 (3-0) f s**
Prerequisite: EE 615 or PY 602
A comprehensive study of electricity and magnetism, emphasizing dynamic field theory. Potential theory, boundary-value problems, electrostatics and magnetostatics, transients in continuous systems, electromagnetic theory of light.

Mr. Tompkins

EE 650 ELECTRICAL ENGINEERING RESEARCH **Credits by arrangement**
Prerequisites: Graduate standing in EE and approval of adviser
Individual research in the field of Electrical Engineering.

Graduate Advisers

EE 661, 662 SPECIAL STUDIES IN ELECTRICAL ENGINEERING **3 (3-0) f s**
Prerequisites: Graduate standing in EE and approval of adviser
This course provides an opportunity for small groups of advanced graduate students to study, under the direction of qualified members of the professional staff, advanced topics in their special fields of interest.

Graduate Staff

— — — — — — — — — — — — — — —ENGINEERING

E 100 INTRODUCTION TO ENGINEERING **1 (1-0) f s**
Introduces the student to the profession of engineering and the characteristics and requirements of the study of engineering.

Mr. Lampe

E 500 ENGINEERING ANALYSIS **3 (3-0)**
Prerequisite: Senior standing and selection for Honors Program in Engineering
This is an engineering "case method" experience, making use of the principles of engineering, physics and mathematics. Professors in Engineering and certain key individuals from industry will work singly with the professor in charge to introduce challenging engineering situations and to stimulate student analysis.

ENGINEERING MECHANICS

COURSES FOR ADVANCED UNDERGRADUATES

EM 311 MECHANICS I (STATICS) **3 (3-0) f s**
Prerequisites: PY 201 or 211; MA 201 or 211
Study of the analytical and graphical solution for the resultant and equilibrium of concurrent, parallel and non-concurrent non-parallel force systems under coplanar or non-coplanar conditions. The application of statics to pin connected members, trusses and cables; friction; centroids; and moments of inertia. Shear and bending moment equations and diagrams.

EM 312 MECHANICS II (DYNAMICS) **3 (3-0) f s**
Prerequisite: EM 311
The kinematic and kinetic study of motion of particles and rigid bodies; absolute and relative motion; Coriolis Law; methods of force, mass and acceleration; work and energy; impulse and momentum. Variable motion, simple harmonic motion, simple balancing of rotating parts.

EM 321 STRENGTH OF MATERIALS I **3 (3-0) f s**
Prerequisite: EM 311
Simple stresses and strains in tension, compression, shear and torsion; external cross shear and bending moments in beams; internal stresses in beam and their distribution throughout the cross section; design of beams; slope and deflection of beams; statically indeterminate reactions of restrained beams; study of stresses at a point by Mohr's circle; column theory; design of axially and eccentrically loaded columns.

EM 341 MECHANICS A (STATICS) **2 (2-0) f s**
Prerequisites: PY 201 or 211 and MA 201 or 211
Forces, resultants and equilibrium of concurrent, parallel and non-concurrent non-parallel force systems; statics applied to engineering problems and the solution of stress in simple trusses. Centroids and moments of inertia. This course is a condensation of EM 311 and with less emphasis.

EM 342 MECHANICS B (DYNAMICS) **2 (2-0) f s**
Prerequisite: EM 341 or 311
The kinematic and kinetic study of motion of particles and rigid bodies; absolute and relative motion. Methods of force, mass and acceleration; work and energy impulse and momentum. This course is a condensation of EM 312 and with less emphasis.

EM 343 STRENGTH OF MATERIALS A **2 (2-0) f s**
Prerequisite: EM 311 or 341
Axial and shear stresses and strains; pure torsion of circular shafts; external shears and moments; the distribution of internal shearing and bending stresses; introduction to deflection theory; column theory; design of axially loaded columns.

EM 430 FLUID MECHANICS **2 (2-0) f s**
Prerequisite: EM 312 or 342
Fluid statics, kinematics, Bernoulli equation, momentum, free-surface flow, viscosity, pipe friction, drag on submerged bodies, lift, elastic wave propagation.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EM 531 HYDRAULIC MACHINERY **2 (2-0) f s**
Prerequisite: EM 430
Theory of lift and application to propellers, fans; blade theory including generalized Bernoulli equation, angular impulse, and angular momentum; forced and free vortex; impulse, reaction, and propeller turbines; positive displacement pumps, centrifugal pumps; propagation in pipes and surge tanks; fluid couplings and torque converters.

EM 551 ADVANCED STRENGTH OF MATERIALS **3 (3-0) f s**
Prerequisite: EM 321
Stresses and strains at a point; rosette analysis; stress theories; stress concentration and fatigue; plasticity; inelastic, composite and curved beams; prestress; energy methods; shear deflections; buckling problems and column design; and membrane stresses in shells.

EM 554 VIBRATION PROBLEMS **3 (3-0) f s**
Prerequisites: EM 312 or 342; EM 321 or 343; MA 401
Free vibrations without damping; natural frequency; forced vibrations without damping; balancing of rotating and reciprocating machinery; free vibrations with damping; forced vibrations with damping; vibration of systems with several degrees of freedom; shock and sound isolation; application of isolators.

EM 556 ADVANCED MECHANICS **2 (2-0) f s**
Prerequisite: EM 312
Virtual work; stability; balancing; elastic impact and waves; governors; LaGrangian equations of motion; three-dimensional dynamics of rigid body gyroscopes derivation from Kepler's laws of Newton's law of gravitation.

COURSES FOR GRADUATES ONLY

EM 601 APPLIED ANALYSIS IN STRENGTH OF MATERIALS **3 (3-0) f s**
Prerequisites: EM 551; MA 401
Advanced problems by energy methods. Difficult internal stress problems. Stresses in thin-webbed beams; stresses in square and curved knees of rigid frames; torsion in rolled profiles; design of beams for bending and torsion; equilibrium and compatibility in two dimensions; Airy's stress function; pure bending of plates; the plate equation; transverse and middle plane loads on plates. Beams on elastic foundations.

EM 602 THEORETICAL AND APPLIED ELASTICITY **3 (3-0) f s**
Prerequisites: EM 321; MA 401
Buckling by torsion and flexure; lateral instability of beams and beam-columns; tapered and built-up columns; local failures; the four-moment theorem; stresses in circular and rectangular plates; stress concentrations. In the above topics, theory is developed and the resulting equations solved by classical or numerical methods. Results are compared with leading design specifications.

EM 605 RESEARCH IN STRENGTH OF MATERIALS **3 (3-0) f s**
Special problems and investigations.

EM 606 RESEARCH IN MECHANICAL VIBRATIONS **3 (3-0) f s**
Special problems in investigations.

EM 607 RESEARCH IN FLUID MECHANICS **3 (3-0) f s**
Special problems in investigations.

EM 608 ADVANCED FLUID MECHANICS **2 (2-0) f s**
Prerequisite: EM 430
Potential motion; vortex theory; Navier-Stokes equations; theories of turbulence; theory of boundary layer; boundary separation; unsteady flow vibrations of fluids.

EM 610 ENGINEERING MECHANICS SEMINAR **1 (1-0) f s**
Reports, discussions and preparation of papers.

ENGLISH

FRESHMAN ENGLISH

ENG 111, 112 COMPOSITION (BASIC COMMUNICATIONS SKILLS) **3 (3-0) f s**
Required of all freshmen
Intensive practice in composition, with review in grammar and usage; reading and analysis of basic types of communication, with primary emphasis on comprehension; directed supplementary reading; oral and written reports; conferences.

WRITING

ENG 211 BUSINESS COMMUNICATIONS **3 (3-0) f s**
Prerequisite: ENG 112
Practical application of the principles of composition to effective business communications, including basic types of correspondence and reports. Special attention will be paid to vocabulary building, and work will be given in oral business communications.

ENG 215 PRINCIPLES OF NEWS AND ARTICLE WRITING **3 (3-0) f s**
Prerequisite: ENG 112
Introduction to the writing of simple news articles; class criticism of non-technical newspaper and magazine articles.

ENG 216 ADVANCED ARTICLE WRITING **3 (3-0) s**
Prerequisites: ENG 112 and 215 or equivalent
A continuation of ENG 215, with intensive practice in writing and criticizing nontechnical articles.

ENG 222 ADVANCED COMPOSITION (CREATIVE WRITING) **3 (3-0) s**
Prerequisite: ENG 112
A course in creative writing especially designed for students who have demonstrated ability; emphasis on short prose fiction.

ENG 223 VOCABULARY BUILDING **3 (3-0) s**
Prerequisite: ENG 112
A system of increasing the student's supply of useful words as found in the best modern English prose.

ENG 321 SCIENTIFIC WRITING **3 (3-0) f s**
Prerequisite: ENG 112
Intensive practice in writing technical and scientific reports, articles for journals, and business letters relating to technical reports.

ENG 324 ADVANCED GRAMMAR **3 (3-0) s**
An intensive study of English grammer with attention to the historical development of the language and with special emphasis on contemporary usage.

ENGLISH

SPEECH

ENG 231 BASIC SPEAKING SKILLS **3 (3-0) f s**
Prerequisite: ENG 112
Training in the fundamentals of public speaking; supplementary training in some aspects of group discussion (panel, forum, symposium or committee) and in the techniques of good listening.

ENG 332 ARGUMENTATION AND PERSUASION **3 (3-0) f**
Prerequisite: ENG 231 or equivalent
Analysis, brief-drawing and evidence, and methods of proof and refutation; fundamentals of conviction; naturalness and forcefulness, extempore speeches, debates and discussions.

ENG 333 PUBLIC ADDRESS AND EXTEMPORANEOUS SPEAKING **3 (3-0) s**
Prerequisite: ENG 231 or equivalent
Public speaking for special occasions, including speech of introduction, committee-room speech, after-dinner speech, speech at professional convention, political speech, formal sales talk.

ENG 334 ORAL READING **3 (3-0) s**
Prerequisites: ENG 112 and 231, or approval of the department
Training in the analysis and presentation of printed materials, technical and semi-technical, for platform, radio, and television. Emotional reactions to add color and interest; expressive body and voice; correction of faulty habits.

ENG 336 PARLIAMENTARY PRACTICE **3 (3-0) f s**
Prerequisite: ENG 112
(Not to be counted toward the fulfillment of any requirement in languages, humanities or social sciences without specific authorization.)
Rules and customs of assemblies, including organization, motions; participation in and conduct of meetings; parliamentary strategy.

ENG 337 GROUP DISCUSSION **3 (3-0) f**
Prerequisites: ENG 112 and 231, or approval of the department
The theory and practice of leading and taking part in such groups as panels, forums, symposiums, conferences and committees. Oral and written assignments. Frequent recordings.

LITERATURE

Note: ENG 111 and 112 are prerequisites to all courses in literature

ENG 205 READING FOR DISCOVERY **3 (3-0) f s**
A study of selected poems, plays, and short stories drawn from English, American, and European literature with emphasis on the great themes of literature and on the approach of the creative artist to basic ideas in Western culture.

ENG 361 BACKGROUNDS OF ENGLISH CIVILIZATION (I) **3 (3-0) f**
A reading course in English literature from the Anglo-Saxon invasions to the Romantic period, with an emphasis on the contributions of English life and thought to Western Civilization.

ENG 362 BACKGROUNDS OF ENGLISH CIVILIZATION (II) **3 (3-0) s**
English literature from the Romantic period to the present day. This course may be taken either as a continuation of ENG 361 or as an independent course.

ENG 365 THE AMERICAN MIND (I) **3 (3-0) f**
The development of American thought and civilization as reflected in American literature from the colonial settlements through the New England revival of the nineteenth century.

ENG 366 THE AMERICAN MIND (II) **3 (3-0) s**
The background of contemporary American literature and thought, from Mark Twain to Hemingway and Faulkner. This course may be taken either as a continuation of ENG 365 or as an independent course.

ENG 375 SOUTHERN WRITERS **3 (3-0) s**
An introduction to Southern culture as revealed in poetry and short fiction from Poe to the present day. Readings in the Southern essay dealing with social, political, and literary problems.

ENG 382 SHORT PROSE FICTION **3 (3-0) f**
The study of selected short stories by the most representative of contemporary British and American writers.

ENG 385 SHAKESPEARE **3 (3-0) s**
A study of the principal plays with emphasis on reading Shakespeare for enjoyment.

ENG 396 LITERATURE OF THE WESTERN WORLD (I) **3 (3-0) f**
Readings from selected great books from the Homeric period of Greek literature to the Renaissance in Europe. Emphasis on the contributions of this literature to modern thought.

ENG 397 LITERATURE OF THE WESTERN WORLD (II) **3 (3-0) s**
Readings from selected great books from the Renaissance to the twentieth century with emphasis on literary appreciation and on the development of important concepts underlying contemporary life in the Western World. This course may be taken either as a continuation of ENG 396 or as an independent course.

ENG 398 CONTEMPORARY LITERATURE **3 (3-0) s**
A study of selected examples of American, British, and Continental writing from 1915 to the present day with reference to changing literary forms and themes.

ENTOMOLOGY

COURSES FOR UNDERGRADUATES

ENT 301 INTRODUCTION TO FOREST INSECTS **3 (2-2) f**
Prerequisite: School of Forestry
An introductory course covering the fundamentals of classification, development, habits and control of forest insects.

Mr. Brett

ENT 312 ECONOMIC ENTOMOLOGY **3 (2-2) s**
Prerequisite: ZO 101
A basic course, covering the fundamentals of insect classification, development, food habits and controls.

Mr. Brett

ENT 322 BEEKEEPING **3 (1-4) s**
Prerequisite: Consent of Instructor
A basic course dealing with the place of the honeybee in our agricultural economy; the colony and its components; management; manipulation; honey production, care and marketing.

Mr. Stephen

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ENT 501, 502 INSECT MORPHOLOGY **3 (1-4) f s**
Prerequisite: ENT 301 or 312
Covers general morphology, external and internal, of the insects and their relatives. ENT 501 will deal primarily with external morphology and ENT 502 with internal morphology.
(Given on odd years)

Mr. Young

ENT 511 SYSTEMATIC ENTOMOLOGY **3 (1-4) f**
Prerequisite: ENT 301 or 312
A somewhat detailed survey of the orders and families of insects, designed to acquaint the student with these groups and develop in the student some ability in the use of keys, descriptions, etc.
(Given on even years)

Mr. Young

ENT 522 ENTOMOLOGICAL TECHNIQUE **3 (1-4) s**
Prerequisite: ENT 301 or 312
A laboratory course designed to acquaint the student with the various methods and techniques commonly employed in entomology, including a brief introduction to drawing and the photographic process.
(Given on even years)

Mr. Young

ENT 531 INSECT ECOLOGY AND BEHAVIOR **3 (3-0) f**
Prerequisite: ENT 301 or 312
The influence of environmental factors on insect development, distribution and behavior.
(Given on even years)

Mr. Brett

4 (2-4) f

ENT 541, 542 IMMATURE INSECTS **2 (1-2) s**
Prerequisite: ENT 511 or permission of instructor
541 is a study of the characteristics of the immature forms of the order sand principal families of insects. 542 is a detailed study of the immature forms of some special group of insects of the students' own choosing.
(Given on even years)

Mr. Rabb

ENT 551, 552 APPLIED ENTOMOLOGY **3 (2-2) f s**
Prerequisite: ENT 301 or 312
An advanced course in which the principles of applied entomology are studied in respect to the major economic insect pests. Methods of determining and examining insect damage, the economic importance of insects and the chief economic pests of man, food and fiber are studied as well as laws and regulations pertaining to insects and insecticides.
(Given on odd years)

Mr. Kulash

ENTOMOLOGY

ENT 561 LITERATURE AND HISTORY OF ENTOMOLOGY **3 (3-0) f**
Prerequisite: ENT 301 or 312
A general course intended to acquaint the student with literature problems of the scientist, mechanics of the library and book classification, bibliographies of the zoological sciences, abstract journals, forms of bibliographies, forms of literature, preparation of scientific paper; taxonomic indexes and literature (with a historical background) and history of the development of zoological science from ancient to modern times with emphasis on entomology.
(Given on odd years)

Mr. Brett

ENT 571 FOREST ENTOMOLOGY **3 (2-2) f**
Prerequisites: ENT 301 or 312
A study of methods of identification of forest pests, the factors governing their abundance, habits and control.

Mr. Kulash

ENT 582 (ZO 592) MEDICAL ENTOMOLOGY (Parasitology II) **3 (2-3) s**
Prerequisite: ENT 301 or 312
A study of the morphology, biology and control of the parasitic arthopods of man, domestic and wild animals.
(Given on odd years)

Mr. Harkema

ENT 590 SPECIAL PROBLEMS **Credits by arrangements**
Prerequisites: Graduate standing and consent of the instructor
Original research on special problems in entomology not related to a thesis problem, but designed to provide experience and training in research.

Staff

COURSES FOR GRADUATES ONLY

ENT 601, 602 PRINCIPLES OF TAXONOMY **3 (2-2) f**
3 (1-4) s
Prerequisite: ENT 511
A course introducing the methods and tools used in animal taxonomy, designed to promote a better understanding of taxonomic literature and provide a foundation for taxonomic research.
(Given on even years)

Mr. Young

ENT 611 INSECT PHYSIOLOGY **4 (3-2) f**
Prerequisite: ENT 312, 502, CH 451 or equivalent
The course deals with the aspects of animal physiology related to insects. The functions of the various insect organs are discussed and how these systems are disrupted by economic poisons. Laboratory work includes the use of standard physiological apparatus with emphasis on methods rather than obtaining results.
(Given on odd years)

Mr. Gast

ENT 621 INSECT TOXICOLOGY **4 (3-2) f**
Prerequisite: ENT 312, CH 426 or equivalent
The course deals with chemical and physical characteristics of insecticides and formulations and their effects on biological systems. Modes of action and mammalian toxicities are also discussed. Laboratory work involves insect culture work, formulating insecticides and evaluating the effectiveness of various materials.
(Given on even years)

Mr. Gast

ENT 632 ADVANCED SYSTEMATIC ENTOMOLOGY **3 (0-6) s**
Prerequisite: ENT 511
A detailed study of some special insect group of the student's own choosing.

Mr. Young

ENT 680 SEMINAR **1 1**
Prerequisite: Graduate standing in Entomology or closely allied fields
Discussion of entomological topics selected and assigned by Seminar Chairman.

Graduate Staff

ENT 690 RESEARCH **Credits by arrangement**
Prerequisite: Graduate standing in Entomology or closely allied fields
Original research in connection with thesis problem in entomology.

Graduate Staff

EXPERIMENTAL STATISTICS

COURSES FOR UNDERGRADUATES

ST 302 STATISTICAL LABORATORY **2 (1-2) s**
The use of conventional IBM punch card machines with special emphasis on gathering data for punch cards, coding, designing card fields and the operation of the punch, verifier, sorter, collator, tabulator and 602A calculating punch. Complete wiring techniques on the collator, tabulator and 602A calculating punch will be emphasized. Programming of large scale computations found in statistics on the conventional IBM equipment along with a survey of the methods used for programming on the card program calculator (CPC) will be given.

Mr. Verlinden

ST 311 INTRODUCTION TO STATISTICS **3 (2-2) f s**
This course will relate general statistical concept to everyday life and will emphasize giving perspective to these concepts in place of developing skill. Quantitative descriptions of populations, sampling ideas, techniques of making inference about populations from samples and the uncertainties involved in such inferences. Formulation and testing of hypotheses, elementary and basic statistical techniques.

Mr. Monroe

ST 361 INTRODUCTION TO STATISTICS FOR ENGINEERS, I **3 (2-2) f s**
Prerequisite: College Algebra
Survey of statistical techniques useful to engineers and physical scientists. Includes elementary probability, frequency distributions, estimation of means and standard deviations, sampling variation, control charts, elementary least squares curve fitting, Chi-square tests, analysis of variance, elementary design of experiments.

Mr. Hader

ST 362 INTRODUCTION TO STATISTICS FOR ENGINEERS, II **3 (2-2) f s**
Prerequisite: ST 361
Continuation of ST 361. Additional and more advanced statistical methodology for engineers and physical scientists. Includes least squares method for fitting polynomials and multiple regression; principles of sampling finite populations; stratified, systematic and two stage sampling; sampling acceptance inspection; introduction to analysis of variance and design of experiments.

Mr. Hader

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ST 501, 502 BASIC STATISTICAL ANALYSIS **4 (3-2) f s**
Prerequisites: College Algebra and ST 311 or 361 and permission of Department
Description of classification and scaled data; sampling from normal, uniform, binomial and multimodal populations; empirical distributions of various measures of location, dispersion, correlation, regression; significance tests, confidence intervals; collection and analysis of data; surveys, regression, experimental designs, factorial data, variance components, nonparametric methods, sequential analysis. Intended primarily as a parallel course to ST 521-522, to be taken by Statistics majors or Ph.D. minors but not intended as a service course for other departments.

Graduate Staff

ST 511 EXPERIMENTAL STATISTICS FOR BIOLOGICAL SCIENCES, I **4 (3-2) f**
Prerequisite: ST 311 or graduate standing
Basic concepts of statistical models and use of samples, variation and statistical measures, distributions, tests of significance, analysis of variance and elementary experimental design, regression and correlation, chi-square.

Mr. Robinson

ST 512 EXPERIMENTAL STATISTICS FOR BIOLOGICAL SCIENCES, II **3 (3-0) s**
Prerequisite: ST 511
Covariance, multiple regression, factorial experiments, individual degrees of freedom, incomplete block designs, experiments repeated over space and time.

Mr. Mason

ST 513 EXPERIMENTAL STATISTICS FOR SOCIAL SCIENCES, I **4 (3-2) f**
Prerequisite: St 311 or graduate standing
Basic concepts in collection and analysis of data. Variability of sample data, distributions, confidence limits, chi-square, "t"-test, analysis of variance, regression, correlation, analytic and descriptive surveys, experimental designs, index numbers.

Mr. McVay

EXPERIMENTAL STATISTICS

ST 514 EXPERIMENTAL STATISTICS FOR SOCIAL SCIENCES, II **3 (3-0) s**
Prerequisite: 513
Extension of basic concepts of experimental statistics to social surveys and experiments. Sampling from finite populations; sampling systems, unrestricted, stratified and multistage; random and systematic selection with varying probabilities; methods of estimation; analysis of variance with multiple classification; covariance; multiple regression; polynomials.

Mr. Finkner

ST 515, 516 EXPERIMENTAL STATISTICS FOR ENGINEERS **3 (3-0) f**
or 4 (3-2) f
3 (3-0) s

Prerequisite: ST 361 or graduate standing
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, sensitivity data, life testing experiments and experimental design.
One credit optional laboratory available first term only.

Mr. Hader

ST 521, 522 BASIC STATISTICAL THEORY **4 (3-2) f s**
Prerequisites: ST 311 or graduate standing and undergraduate calculus
Probability, frequency distributions and moments; sampling distributions; introductory theory of point and interval estimation; parametric and non-parametric tests of hypotheses; theory of least squares; multiple regression, analysis of variance and covariance, variance components.
This course contains the theory needed in all advanced courses in statistical analysis and some of the fundamentals for advanced theory courses.

Graduate Staff

ST 591 SPECIAL PROBLEMS **1-3 credits by arrangement f s**
Development of techniques for specialized cases, particularly in connection with thesis and practical consulting problems.

Graduate Staff

COURSES FOR GRADUATES ONLY

ST 611, 612 INTERMEDIATE STATISTICAL THEORY **3 (3-0) f s**
Prerequisites: ST 522, Advanced Calculus and Matrix Theory
This course will provide the additional theory, above that of ST 521-522, needed for advanced theory courses. Many of the topics of ST 521-522 will be developed more rigorously, and more attention will be paid to mathematical aspects. Advanced probability theory; central limit theorem, law of large numbers, bivariate normal distributions, convergence theorems. Theory of estimation; method of maximum likelihood, efficient estimates, simultaneous confidence regions; general theory of tests of hypotheses, general linear hypothesis, sequential tests of hypotheses, distribution-free methods.

Mr. Williams

ST 621 STATISTICS IN ANIMAL SCIENCE **3 (3-0) f**
Prerequisite: ST 502 or ST 512
Sources and magnitudes of errors in experiments with animals, experimental designs and methods of analysis adapted to specific types of animal research, relative efficiency of alternate designs, amount of data required for specified accuracy, student reports on selected topics.
(Offered fall of 1959-60 and alternate years)

Mr. Lucas

ST 623 STATISTICS IN PLANT SCIENCE **3 (3-0) f**
Prerequisite: ST 502 or 512
Principles and techniques of planning, establishing and executing field and greenhouse experiments. Size, shape and orientation of plots; border effects; selection of experimental material; estimation of size of experiments for specified accuracy; scoring and subjective tests; subsampling plots and yields for laboratory analysis.

Mr. Mason

ST 626 STATISTICAL CONCEPTS IN GENETICS **3 (3-0) s**
Prerequisites: GN 512, and ST 502 or 512 unless taken concurrently
Factors bearing on rates of change in population means and variances, with special reference to cultivated plants and domestic animals; selection, inbreeding, magnitude and nature of genotypic and non-genotypic variability; experimental and statistical approaches in the analysis of quantitative inheritance.

Mr. Cockerham

ST 631 THEORY OF SAMPLING APPLIED TO SURVEY DESIGN **3 (3-0) f**
Prerequisite: ST 502 or 512 or 514 or 516
Basic theory of sampling from a finite population. Confidence limits and estimation of optimum sample size, comparison of different sample designs, methods and probabilities for selection and methods of estimation, choice of a sampling unit, double sampling, matched samples.

Mr. Finkner

ST 641 (RS 641) STATISTICS IN SOCIOLOGY **3 (3-0) f**
Prerequisite: ST 513
The application of statistical methods in sociological research. Emphasis on selecting appropriate models, instruments and techniques for the more frequently encountered problems and forms of data.

Mr. Hamilton

ST 651 (AGC 651) ECONOMETRIC METHODS, I **3 (3-0) s**
Prerequisites: ST 514, 521, AGC 641 and 642
Decision making under uncertainty, stochastic elements in economic theories, problems of model construction, special techniques for analyzing simultaneous economic relations.

Graduate Staff

ST 652 (AGC 652) ECONOMETRIC METHODS, II **3 (3-0) f**
Prerequisites: ST 513, 522, AGC 641 or 642
Basic concepts of estimation and tests of significance as applied to economic data. Empirical sampling methods, non-parametric methods, sequential testing; extension of least squares methods to research in economics, production surfaces; special topics in variance components and mixed models; use of experimental designs in economic research; elements of multivariate analysis; techniques for analysis of time series.

Mr. Anderson

ST 661, 662 APPLIED MULTIVARIATE ANALYSIS **3 (3-0) f s**
Prerequisites: ST 502 or 514 (Also analytical geometry and elementary properties of determinants)
The general multivariate model for experimental work; relations between multiple regression, analysis of variance and multivariate analysis; factor analysis; the generalized variance; the generalized Student ratio; intra-class correlations; testing compound symmetry between two sample covariance matrices; scale analysis; canonical correlation, testing for the rank of a correlation matrix.

Mr. Nicholson

ST 663 SPECIAL PROBLEMS IN MULTIVARIATE ANALYSIS **3 (3-0) f**
Prerequisite: ST 661
A seminar course devoted to special problems in applied multivariate analysis, particularly designed for advancing the use of these methods in specific research problems.

Graduate Staff

ST 664 PSYCHOLOGICAL ASPECTS OF FACTOR ANALYSIS **3 (3-0) s**
Prerequisite: ST 661
History of factor analysis, theory of two-factors, fictitious factors, hierarchal order, need of group factors, the centroid method, communalities, common factor space, estimation of factors, orthogonal and oblique factors, the problem of rotation, simple structure, second order factors.

Graduate Staff

ST 671 ADVANCED STATISTICAL ANALYSIS **3 (3-0) f**
Prerequisites: ST 502 or 512, ST 522
General computational methods for linear regression, non-orthogonal data, carryover effects, orthogonal polynomials, response surfaces, non-linear systems, variance components for orthogonal and non-orthogonal data.

Mr. Anderson

ST 672 SPECIAL ADVANCED TOPICS IN STATISTICAL ANALYSIS **3 (3-0) s**
Prerequisite: ST 671
Regression analysis with errors in both variables, transformations, enumeration data, discriminant functions, heterogeneous errors, non-parametric analysis.

Mr. Monroe

ST 674 ADVANCED TOPICS IN CONSTRUCTION AND ANALYSIS OF EXPERIMENTAL DESIGNS **3 (3-0) s**
Prerequisites: ST 502 or 512 and ST 522
Inter-block analysis of incomplete blocks designs, partially balanced designs, confounding, data collected at several places and times, multiple factor designs, change-over trials, analysis of groups of means.

Miss Cox

ST 681 SEMINAR **1 (1-0) f s**
A maximum of three credits is allowed toward the master's degree, but any number toward the doctorate.

Graduate Staff

ST 691 RESEARCH **Credits by arrangement f s**
A maximum of nine credits is allowed toward the master's degree; no limitation on credits in doctorate programs.

Graduate Staff

FIELD CROPS

COURSES FOR UNDERGRADUATES

FC 211 FIELD CROPS I **3 (2-2) f s**
Prerequisite: BO 102
Discussion of fundamental principles underlying crop production. The application of these principles to the major and minor field crops. The elements of plant identification, crop grading and judging.

Mr. Lewis

FC 311 FIELD CROPS II **3 (2-2) f**
Prerequisites: FC 211 and SOI 200
Specific problems in field crop production other than forage crops. Discussion of those crops in farm rotations brings together all the major aspects of crop production for different climatic areas.

Mr. Lewis

FC 312 PASTURES AND FORAGE CROPS **3 (3-0) s**
Prerequisites: FC 211 and SOI 200
A study of the production and preservation of the principal forage crops. Special attention is given to the development and maintenance of pastures.

Mr. Chamblee

FC 412 ADVANCED PASTURES AND FORAGE CROPS **2 (2-0) s**
Prerequisite: FC 312
Pasture species and management (cultural treatment) from an international viewpoint, and the inter-relationship of grazing animals on pasture development and management will be emphasized. Natural grassland areas and the place of special plant species will be considered.

Mr. Gilbert

FC 413 PLANT BREEDING **3 (3-0) f**
Prerequisite: GN 411
The application of genetic principles to the improvement of economic plants, including discussions of the methods employed in the development and the perpetuation of desirable clones, varieties and hybrids.

Mr. Harvey

FC 414 WEEDS AND THEIR CONTROL **3 (2-2) s**
Prerequisites: FC 211; CH 203 or equivalent
Principles involved in cultural and chemical weed control. Discussions on chemistry of herbicides and the effects of the chemicals on the plant. Identification of common weeds and their seeds is given.

Mr. Klingman

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

FC 511 TOBACCO TECHNOLOGY **2 (2-0) f**
Prerequisites: FC 311, BO 421 or equivalent
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.

Mr. Jones

FC 521 SPECIAL PROBLEMS **Credits by arrangement**
Prerequisite: Students admitted only with consent of instructor
Special problems in various phases in Field Crops. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research.

Graduate Staff

FC 541 PLANT BREEDING METHODS **3 (3-0) f**
Prerequisites: GN 512; ST 511 recommended
An advanced study of methods of plant breeding as related to principles and concepts of inheritance.

Messrs. Haynes, Mann

FC 542 (GN 542 or HRT 542) PLANT BREEDING FIELD PROCEDURES **2 (0-4) (in Summer Sessions)**
Prerequisite: FC 541 or GN 541 or HRT 541
A laboratory and field study of the application of the various plant breeding technqiues and methods used in the improvement of economic plants.

Messrs. Haynes, Mann

COURSES FOR GRADUATES ONLY*

FC 611 FORAGE CROP ECOLOGY **2 (2-0) s**
Prerequisites: FC 412; BO 441
A study of the effect of environmental factors on the growth of forage crops. Attention will be given to methods of research in forage ecology.
Mr. Chamblee

FC 612 SPECIAL TOPICS IN WEED CONTROL **2 (2-0) s**
Prerequisites or corequisites: BO 403, 532, FC 414
Detailed examination of current concepts in selected fields of weed control. The chemistry, physiology, ecology, taxonomy, microbiology, equipment and techniques used in weed control research will be discussed.
Graduate Staff

FC 631 SEMINAR **1 (1-0) f s**
Prerequisite: Graduate standing
Scientific articles, progress reports in research, and special problems of interest to agronomists reviewed and discussed.
A maximum of two credits is allowed toward the Master's degree.
Graduate Staff

FC 641 RESEARCH **Credits by Arrangement**
Prerequisite: Graduate standing
A maximum of six credits is allowed toward the Master's degree.
Graduate Staff

FORESTRY

COURSES FOR UNDERGRADUATES

FOR 101, 102 INTRODUCTION TO FORESTRY **2 (1-3) f s**
The profession of Forestry, its scope and opportunities; conservation of natural resources; forestry field practice.
Mr. Prestor

FOR 201 WOOD STRUCTURE AND PROPERTIES I **3 (1-4) f**
Identification, structure, properties and uses of woods of economic importance in the United States; identification by means of the hand lens is especially emphasized.
Mr. Slocum

FOR 202 WOOD STRUCTURE AND PROPERTIES II **2 (0-6) s**
Continuation of FOR 201 Microscopic identification and techniques are emphasized.
Mr. Slocum

FOR s204 SILVICULTURE **2 credits**
Sophomore Summer Camp
Growth and development of forest stands, reproduction counts, type of mapping, thinning and weeding; establishment and measurement of sample plots.
Mr. Miller

FOR s214 DENDROLOGY **2 credits**
Sophomore Summer Camp
Identification and study of trees in Piedmont and mountain sections of North Carolina.
Mr. Slocum

FOR s224 FOREST MAPPING **2 credits**
Sophomore Summer Camp
Field problems in forest mapping, including boundary location and type mapping.
Mr. Bryant

FOR s264 PROTECTION AND UTILIZATION **2 credits**
Sophomore Summer Camp
Prevention, presuppression and suppression of forest fires, fire behavior.
Mr. Bryant

FOR s274 MENSURATION **2 credits**
Prerequisite: CE 217
Sophomore Summer Camp
Collection of field data for stand and yield tables, stem analysis and timber surveys.
Mr. Slocum

* Students are to consult the instructor before registration.

FORESTRY

FOR 303 WOOD-MOISTURE RELATIONS **3 (2-2) s**
Shrinking and swelling characteristics of wood; air seasoning; dry kiln construction; kiln operation; scedules and conditioning; lumber storage and moisture control during manufacture; dimensional stabilization methods, processes, equipment and materials.
Mr. Carter

FOR 311 PRINCIPLES OF FARM FORESTRY **2 (1-3) f**
The theory and practice of forestry with special reference to the handling of farm woodlands and the utilization of their products; the place of forestry in farm management and the agricultural economy.
Mr. Bryant

FOR 321, 322 PULP AND PAPER TECHNOLOGY **3 (3-0) f s**
Brief survey of the physical and chemical characteristics of wood and cellulose. Chemistry and technology of the major mechanical, chemical and semi-chemical processes employed in the manufacture of pulp and paper.
Mr. Hitchings

FOR 361 SILVICS **3 (3-0) s**
Site, soil and other environmental factors in relation to the establishment, growth and development of seedlings, trees and timber stands; the influence of forest vegetation on site development, ground water and micro-climate.
Mr. Maki

FOR 372 MENSURATION **3 (2-2) f**
Prerequisite: FOR s274
The measurement of timber, both standing and felled; log rules, form factors, stem analysis and growth; methods of making volume, growth and stand tables; increment and yield studies; development of stand and yield tables from field data.
Mr. Slocum

FOR 401 WOOD PRESERVATION **2 (1-3) s**
Factors causing wood deterioration; preservative materials and treatments; wood by-products from mill and forest waste.
Mr. Carter

FOR 402 FOUNDATIONS OF FOREST MANAGEMENT **2 (2-0) f**
Prerequisites: FOR s274 or FOR 311
The integration of silviculture, forest measurements and economics in the management of woodland areas. (Not open to students majoring in forest management.)
Mr. Bryant

FOR 403 PAPER TECHNOLOGY LABORATORY **3 (0-6) s**
(First 8 weeks)
Development of various types of paper finishes with particular attention to stock preparation, sizing, filling and coloring. The finished products are tested physically and chemically and evaluated from the standpoint of quality and in comparison with the commercial products they are intended to duplicate.
Mr. Hitchings

FOR 404 MANAGEMENT PLANS **3 (1-6) s**
Senior Camp
Application of management, logging, silvicultural and utilization practices on assigned areas. Each student must make a forest survey of an individual area and submit a record.
Staff

FOR 405 FOREST INVENTORY **2 (0-6) s**
Senior Camp
Practical field work in timber estimating and compilation of field data.
Mr. Bryant

FOR 406 FOREST INDUSTRIES **2 (0-6) s**
Senior Camp
A field study of logging, milling and manufacturing with reports based on inspection trips.
Staff

FOR 407 FIELD SILVICULTURE **2 (0-6) s**
Senior Camp
Prerequisite: FOR 361
Studies of forest communities; dendrology of the coastal section of North Carolina: silviculture practices.
Mr. Miller

FOR 411 PULP AND PAPER MILL EQUIPMENT **3 (3-0) f**
Principles of operation, construction and design of process equipment employed in the pulp and paper industry.

Mr. Cook

FOR 412 PULP AND PAPER MILL EQUIPMENT **2 (1-3) s**
Continuation of FOR 411

Mr. Cook

FOR 413 PAPER TESTING LABORATORY **2 (0-12) f (First 8 weeks)**
Physical, chemical, and microscopical examination of experimental and commercial papers and evaluation of the results in terms of the utility of the product tested.

Mr. Cook

FOR 422 FOREST PRODUCTS **3 (3-0) f**
Prerequisites: FOR 201, CH 203 or 426
The source and method of obtaining derived and manufactured forest products other than lumber.

Mr. Thomas

FOR 423 LOGGING AND MILLING **3 (2-3) f s**
Timber harvesting and transportation methods, equipment and costs; safety and supervision; manufacturing methods with regular and short-log types of sawmills.

Mr. Carter

FOR 431 DIMENSION STOCK MANUFACTURING **3 (2-3) f**
Manufacturing and production methods for manufacturing dimension stock, flooring prefabricated stock, turnings and cut stock. Production rates, plant layout and mechanization peculiar to the industry.

Mr. Carter

FOR 432 MERCHANDISING FOREST PRODUCTS **2 (2-0) f**
Principles and practices in the distribution and marketing of the products obtained from wood; organization and operation of retail, concentration and wholesale outlets.

Mr. Carter

FOR 433 GLUING AND PLYWOOD **3 (2-3) f**
Prerequisites: CH 103 or 203, FOR 303
Veneer manufacturing methods and equipment; veneer products; cold-press and hot-press banding adhesives; processing and use requirements; cause and prevention of inadequate bands; molded, flat and post-formed plywood construction.

Mr. Thomas

FOR 441 MECHANICAL PROPERTIES OF WOOD **3 (2-3) f**
Prerequisites: FOR 201, 303
Strength and related properties of commercial woods; standard A.S.T.M. strength tests; toughness; timber fastenings; structural requirements; working stresses.

Mr. Thomas

FOR 442 FURNITURE CONSTRUCTION AND ASSEMBLY **3 (2-3) f**
Prerequisites: FOR 303, 433
Stock preparation for gluing; selecting adhesives; types of metal fastenings; joint construction and methods of joining wood and other materials; assembly methods for furniture and other wood products; construction and strength properties of laminated members.

Mr. Carter

FOR 443 WOOD FINISHiNG **3 (2-3) s**
Prerequisites: FOR 201, CH 203 or 426
Preparation of wood surfaces for finish coatings; composition and application of paints, varnishes, repellents, lacquers and other wood finishing materials; finishing furniture and interior wood products.

Mr. Carter

FOR 444 INTRODUCTION TO QUALITY CONTROL **3 (2-3) s**
Prerequisites: ST 361
A study of methods used to control quality of manufactured wood products. Control charts for variables and attributes. Acceptance sampling techniques including single, double and sequential sampling methods.

Mr. Barefoot

FORESTRY

FOR 451 PAPER COLORING LABORATORY **2 (0-12) f (First 8 weeks)**
Evaluation and identification of dyestuffs and the development of color formulas for dyeing pulp and paper.

Mr. Libby

FOR 452 FOREST GRAZING **2 (2-0) f**
Management of range areas, all grazing regions with special consideration of the Southeast.

Mr. Bryant

FOR 453 LUMBER STRUCTURES **3 (2-3) s**
Prerequisite: FOR 441
Structural grades of lumber; working stresses; frame construction; construction estimates and computations; masonry, insulation, roofing and other structural materials; millwork; fastenings; prefabs.

Mr. Barefoot

FOR 461 PAPER CONVERTING **1 (1-0) f**
A survey of the principal processes by which paper and paper board are fabricated into the utilitarian products of everyday use.

Mr. Cook

FOR 462 ARTIFICIAL FORESTRATION **2 (1-3) s**
Production, collection, extraction and storage of forest tree seeds; nursery practice; field methods of planting.

Mr. Slocum

FOR 463 PLANT INSPECTIONS **1 (0-3) s**
One week inspection trips covering representative manufacturers of pulp and paper and papermaking equipment.

Staff

FOR 471 PULP TECHNOLOGY LABORATORY **4 (0-12) f**
Preparation and evaluation of the several types of wood pulp. The influence of the various pulping and bleaching variables on pulp quality are studied experimentally and these data evaluated critically.

Mr. Hitchings

FOR 472 FOREST POLICY AND ADMINISTRATION **2 (2-0) f**
Civil timber law, illustrated by court cases; state and federal forest policy; job-load analysis in national forest administration.

Mr. Miller

FOR 481 PULPING PROCESSES AND PRODUCTS **2 (2-0) f**
Prerequisites: FOR 201, CH 203 or 426
Fiber manufacturing processes and equipment; wall, insulation and container board products; manufacture of roofing felts; pulp products manufacturing; resin treated and specialty products, lignin and wood sugar products.

Mr. Libby

FOR 482 PULP AND PAPER MILL MANAGEMENT **2 (2-0) s**
A survey of the economics of the pulp and paper industry is followed by a study of the work of the several departments of a paper mill organization and the functions of the executives who administer them.

Mr. Libby

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

FOR 501 FOREST VALUATION **3 (2-3) f**
Prerequisite: FOR 372
The theory and techniques of valuation of forest land, timber stands and forest practices as investments and for appraisals of damage. Risks and hazards in forestry as they apply to forest investments, forest insurance and forest taxation.

Mr. Bryant

FOR 511 SILVICULTURE **3 (3-0) f**
Prerequisite: FOR 361, BO 421
The principles and application of intermediate and reproductive methods of cutting; controlled burning, silvicides and other methods of hardwood control. The application of silvicultural methods in the forests of the United States.

Mr. Miller

FOR 512 FOREST ECONOMICS **3 (3-0) f**
Prerequisites: FOR 372, EC 201
Economics and social value of forests; supply of and demand for forest products; land use; forestry as a private and a public enterprise; economics of the forest industries.

Mr. Bryant

FOR 513 TROPICAL WOODS **2 (0-4) s**
Prerequisites: FOR 202
Structure, identification, properties, characteristics and use of tropical woods, especially those used in plywood and furniture.

Mr. Bethel

FOR 531 FOREST MANAGEMENT **3 (4-6) s (First 8 weeks)**
Prerequisites: FOR 372, Corequisite: FOR 511
Management of timber lands for economic returns; the normal forest taken as the ideal; the application of regulation methods to the forest.

Mr. Maki

FOR 533 ADVANCED WOOD STRUCTURE AND IDENTIFICATION **2 (0-6) f**
Prerequisite: FOR 202
Advanced microscopic identification of the commercial woods of the United States and same tropical woods; microscopic anatomical features and laboratory techniques.

Mr. Slocum

FOR 542 FIBER ANALYSIS **2 (0-6) s**
Prerequisite: FOR 202
Fiber microscopy; the determination of fiber measurement, quality, variation and identity in pulp woods.

Mr. Barefoot

FOR 553 FOREST PHOTOGRAMMETRY **2 (2-6) s (First 8 weeks)**
Prerequisite: FOR 372, Corequisite: 531
Interpretation of aerial photographs, determination of density of timber stands and area mapping.

Mr. Slocum

FOR 573 METHODS OF RESEARCH IN FORESTRY **Credits Arranged**
Prerequisite: Senior or Graduate Standing
Research procedures, problem outlines, presentation of results; consideration of selected studies by forest research organizations; sample plot technique.

Messrs. Bethel and Maki

FOR 591 FORESTRY PROBLEMS **Credits Arranged**
Prerequisite: Senior or Graduate Standing
Assigned or selected problems in the field of silviculture, logging, lumber manufacturing, pulp technology, or forest management.

Staff

COURSES FOR GRADUATES ONLY

FOR 601 ADVANCED FOREST MANAGEMENT PROBLEMS **Credits Arranged**
Prerequisite: Senior or Graduate Standing
Directed studies in forest management

Graduate Staff

FOR 603 TECHNOLOGY OF WOOD ADHESIVES **3 (2-3) f s**
Prerequisites: CH 425, 426; FOR 433
The fundamentals of adhesives as applied to wood-to-wood and wood-to-metal banding. Technology of adhesives. Preparation and use of organic adhesives. Testing of adhesives and evaluation of quality of adhesives and bonded joints.

Mr. Bethel

FOR 604 TIMBER PHYSICS **3 (2-2) f s**
Prerequisites: FOR 441
Density, specific gravity and moisture content variations affecting physical properties; physics of drying at high and low temperatures; thermal, sound, light and electrical properties of wood.

Mr. Bethel

FOR 605 DESIGN AND CONTROL OF WOOD PROCESSES **3 (2-3) f or s**
Prerequisite: FOR 604
Design and operational control of equipment for processing wood.

Mr. Bethel

FOR 606 WOOD PROCESS ANALYSIS **3 (2-2) s**
Prerequisites: FOR 512, 604
Study of design and operational control of equipment for machinery, drying, gluing, finishing and preserving woods.

Mr. Bethel

GENETICS

FOR 607 ADVANCED QUALITY CONTROL **3 (2-3) s**
Prerequisites: FOR 606, ST 515
Advanced statistical quality control as applied to wood processing.

Mr. Bethel

FOR 611 FOREST GENETICS **3 (2-3) f or s**
Prerequisites: GN 411 and permission of instructor
Application of genetic principles to silviculture, management and pulp utilization. Emphasis is on variations in wild populations, on the bases for selection of desirable qualities and on fundamentals of controlled breeding.

Mr. Zobel

FOR 621 ADVANCED TECHNOLOGY PROBLEMS **Credits Arranged**
Prerequisite: Graduate Standing
Selected research in the field of wood technology.

Graduate Staff

FOR 671 PROBLEMS IN RESEARCH **Credits Arranged**
Prerequisite: Graduate Standing
Specific forestry problems that will furnish material for a thesis.

Graduate Staff

FOR 681 GRADUATE SEMINAR **1 (0-2) f s**
Prerequisite: Graduate Standing
Presentation and discussion of progress reports on research, special problems and outstanding publications in forestry and related fields.

Messrs. Bethel and Maki

GENETICS

COURSES FOR ADVANCED UNDERGRADUATES

GN 411 THE PRINCIPLES OF GENETICS **3 (2-2) f**
Prerequisites: BO 102, ZO 101
An introductory course. The physical basis of inheritance; genes as units of heredity and development; qualitative and quantitative aspects of genetic variation.

Mr. Grosch

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

GN 512 GENETICS **4 (3-2) f**
Prerequisite: GN 411
Intended for students desiring more thorough and detailed training in fundamental genetics with some attention to physiological aspects. (Students conduct individual laboratory problems.)

Mr. Grosch

GN 513 CYTOGENETICS I **4 (3-2) f**
Prerequisite: GN 411
Recommended: GN 512
Variations in the chromosomal mechanisms of inheritance and their genetic consequences. The chromosomes as they affect breeding behavior in plants and animals. Lectures and laboratory.

Mr. Gerstel

*** GN 540 EVOLUTION** **3 (3-0) f**
Prerequisite: GN 411
The facts and theories of evolution in plants and animals. The causes and consequences of organic diversity.

Mr. Smith

GN 541 PLANT BREEDING METHODS **3 (3-0) f**
Prerequisite: GN 521
Recommended ST 511
An advanced study of methods of plant breeding as related to principles and concepts of inheritance.

Messrs. Haynes, Mann

GN 542 (FC 542 or HRT 542) PLANT BREEDING FIELD PROCEDURES **2 (0-4)** (in summer sessions)
Prerequisite: GN 541
A laboratory and field study of the application of the various plant breeding techniques and methods used in the improvement of economic plants.

Messrs. Haynes and Mann

* Given 1958-59 and alternate years.

The following courses, offered in other departments, are available for graduate credit in Genetics:

GN 503 (See AI 503 Animal Breeding). **3 (3-0) f**

GN 520 (See PO 520 Poultry Breeding). **3 (3-0) f**

** **GN 532 (See ZO 532 Biological Effects of Radiations).** **3 (3-0) s**

COURSES FOR GRADUATES ONLY

** **GN 614 CYTOGENETICS II** **3 (0-6) s**
Prerequisite: GN 513 or equivalent
Laboratory and discussion: The cytogenetic analysis of natural and experimental material, plant and animal. Assigned exercises and student projects. The course provides the student with a working knowledge of cytogenetic procedure. Designed for those who expect to become professional breeders or geneticists.

Mr. Smith

** **GN 620 GENETIC CONCEPTS OF SPECIATION** **3 (3-0) s**
Prerequisites: GN 512 and either GN 513 or 540
Review of current ideas on the mechanisms of the origin of species and the nature of species differentiation.

Mr. Stephens

* **GN 621 GENETICS OF POPULATIONS** **3 (3-0) s**
Prerequisite: GN 512
Recommended: GN 540
Review of the forces molding the genetic structure of natural and artificial populations of plants and animals.

Mr. Lewontin

* **GN 633 PHYSIOLOGICAL GENETICS** **3 (3-0) s**
Prerequisite: GN 512
Recent advances in physiological genetics. Attention will be directed to literature on the nature and action of genes, and to the interaction of heredity and environment in the expression of the characteristics of organisms.

Mr. Grosch

GN 641, 642 COLLOQUIUM IN GENETICS **3 (3-0) f s**
Prerequisites: Graduate standing, consent of instructor
Informed group discussion of prepared topics assigned by instructor.

Graduate Staff

GN 651, 652 SEMINAR **1 (1-0) f s**
Prerequisite: Graduate standing

GN 661, 662 RESEARCH **Arranged**
Prerequisite: Graduate standing
Original research related to the student's thesis problem. A maximum of six credits for the Master's degree; by arrangement for the Doctorate.

The following courses, offered in other departments, are available for graduate credit in Genetics:

GN 602 (see AI 602 Advanced Animal Breeding). **3 (3-0) s**

GN 626 (see ST 626 Statistical Concepts in Genetics). **3 (3-0) s**

— — — — — — — — — — GEOLOGICAL ENGINEERING

COURSES FOR UNDERGRADUATES

MIG 101 EARTH SCIENCE **3 (3-0) s**
Elective. Not to be taken after MIG 120
Introductory course in General Geology; changes in the earth, and underlying physical and life processes.

Staff

MIG 120 PHYSICAL GEOLOGY **3 (2-3) f s**
Dynamic processes acting on and within the earth; materials and makeup of the earth's crust; emphasis on engineering and agricultural applications in the southeast. Lectures, laboratories and field trips.

Staff

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* Given 1958-59 and alternate years
** Given 1959-60 and alternate years

GEOLOGICAL ENGINEERING

MIG 222 HISTORICAL GEOLOGY **3 (2-3) s**
Prerequisite: MIG 120
Chronologic account of the geological events during the development of the earth's crust, mainly in North America. Evolution and environmental significance of the principal fossil animal and plant groups.

Staff

MIG 323 PALEONTOLOGY **3 (2-3) f s**
Prerequisite: MIG 222
Study of fossil life forms, with major emphasis on classification and structure of the invertebrate animals and their application to problems of correlation of strata. Lectures, laboratories and field trips.

Staff

MIG 325 GEOLOGY AND MINERAL RESOURCES OF NORTH CAROLINA **3 (2-3) f s**
Prerequisite: MIG 120
Physical geography, general geology, common rocks and minerals, and mines and quarry products of the State. Lectures, laboratories and field trips.

Staff

MIG 330 MINERALOGY **3 (1-6) f**
Prerequisite: CH 103
Crystallography, and physical and chemical mineralogy. Lectures and laboratory work.

Mr. Miller

MIG 351 STRUCTURAL GEOLOGY **3 (2-3) f**
Prerequisite: MIG 120
Structures imposed on igneous, sedimentary, and metamorphic rock masses by deformation and movement in the earth's crust. Lectures, laboratories and field trips.

Mr. Parker

MIG 372 ELEMENTS OF MINING ENGINEERING **4 (2-6) s**
Prerequisite: MIG 120 and junior standing
Introduction to mining: methods of development and exploitation, drilling and blasting, mining law, administration and safety. Lectures, laboratory work and field trips.

Mr. Miller

MIG 411, 412 ECONOMIC GEOLOGY **3 (2-3) f s**
Prerequisites: MIG 120, 330
Mode of occurrence, association, origin, distribution and uses of economically valuable minerals. Lectures, laboratories and field trips.

Staff

MIG 442 PETROLOGY **3 (2-3) s**
Prerequisites: MIG 120, 330
Materials of the earth's crust; composition, texture, classification, megascopic identification, and alterations of the principal igneous, sedimentary and metamorphic rocks. Lectures, laboratories and field trips.

Mr. Parker

MIG 452 SEDIMENTATION AND STRATIGRAPHY **3 (2-3) s**
Prerequisite: MIG 442
Sedimentary processes, products, and structures. Principles of sub-division of sedimentary terranes into natural units and the determination of their ages and history. Lectures, laboratories and field trips.

Mr. Parker

MIG 461 ENGINEERING GEOLOGY **3 (3-0) f**
Prerequisite: MIG 120
The application of geologic principles to engineering practice; analysis of geologic factors and processes affecting specific engineering projects.

Mr. Miller

MIG 462 GEOLOGICAL SURVEYING **3 (1-6) s**
Prerequisites: MIG 351, 442
Methods of field observation and use of geologic surveying instruments in surface and underground work; representation of geologic features by maps, sections and diagrams. Lectures, laboratories and field work.

Messrs. Miller, Parker

MIG 481, 482 SENIOR SEMINAR **1 (1-0)**
Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MIG 510 MINERAL INDUSTRY **3 (3-0) s**
Prerequisite: Senior standing in Mineral Industries
Economics of mineral industry. Cycles of mineral production. Exhaustibility. Reserves. Valuation of mineral property. National resources; essential, critical and strategic minerals. World distribution and production.

Mr. Parker

MIG 522 PETROLEUM GEOLOGY **3 (3-0) s**
Prerequisites: MIG 351, 442
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.

Staff

MIG 531 OPTICAL MINERALOGY **3 (1-4) f**
Prerequisites: MIG 330 and PY 202
Optical principles involved in the petrographic (polarizing) microscope and related instruments. Microscopic determination of minerals in thin section and in fragments. Lectures and laboratory work.

Mr. Parker

MIG 552 GEOPHYSICS **3 (2-3) s**
Prerequisites: MIG 351, PY 202
Fundamental principles underlying all geophysical methods; procedure and instruments involved in gravitational, magnetic, seismic, electrical and other methods of studying geological structures and conditions; study of applications and interpretations of results.

Mr. Miller

MIG 571, 572 MINING AND MINERAL DRESSING **3 (2-3) f s**
Prerequisite: MIG 372
Principles of the mineral industry; mining laws, prospecting, sampling, development, drilling, blasting, handling, ventilation and safety; administration; surveying, assaying; preparation, beneficiation and marketing.

Mr. Miller

MIG 581 GEOMORPHOLOGY **3 (2-3) f**
Prerequisite: MIG 442
A systematic study of land forms and their relations to processes, stages of development, and adjustment to underlying structure. Lectures, map interpretations, and field trips.

Staff

COURSES FOR GRADUATES ONLY

MIG 611, 612 ADVANCED ECONOMIC GEOLOGY **3 (3-0) f s**
Prerequisites: MIG 411, 412
Detailed study of the origin and occurrence of specific mineral deposits.

Graduate Staff

MIG 632 MICROSCOPIC DETERMINATION OF OPAQUE MINERALS **3 (0-6) s**
Prerequisite: MIG 531
Identification of metallic, opaque minerals in polished sections by physical properties, etch reactions and microchemical tests. Laboratories.

Mr. Parker

MIG 642 ADVANCED PETROGRAPHY **3 (1-4) s**
Prerequisites: MIG 442, 531
Application of the petrographic microscope to the systematic study of the composition and origin of rocks; emphasis on igneous and metamorphic rocks.

Mr. Parker

MIG 681, 682 SEMINAR **1 (1-0) f s**
Prerequisite: Graduate standing
Scientific articles, progress reports and special problems of interest to geologists and geological engineers discussed.

Graduate Staff

MIG 691 GEOLOGICAL RESEARCH **3 or 6**
Prerequisite: Permission of the instructor
Lectures, reading assignments, and reports; special work in Geology to meet the needs and interests of the students.

Graduate Staff

HISTORY AND POLITICAL SCIENCE

COURSES IN HISTORY FOR UNDERGRADUATES

HI 201 THE ANCIENT WORLD **2 (2-0) f**
A history of ancient times from the rise of civilization in Egypt and Babylonia to the decline of Rome in the fifth century. Emphasis is placed upon the evolution of cultures and civilizations, and upon the development of art, science, literature and philosophy.

HI 202 THE MEDIEVAL WORLD **2 (2-0) s**
The political, economic, social and cultural developments from the decline of the Roman Empire in the West to the emergence of the modern period.

HI 205 THE MODERN WESTERN WORLD **3 (3-0) f s**
A history of major movements in the Western World from the Renaissance to the present.

HI 225, 226 MODERN EUROPE **3 (3-0) f s**
A study of the political, economic, intellectual and social developments in Europe from the age of Columbus to the present. The course divides at 1815. The semesters may be taken separately.

HI 251 THE UNITED STATES TO 1865 **3 (3-0) f**
A study of major historical developments in the growth of the American nation through the Civil War.

HI 252 THE UNITED STATES SINCE 1865 **3 (3-0) f s**
A study of major historical developments in the growth of the American nation since the Civil War.

HI 261 THE UNITED STATES IN WESTERN CIVILIZATION **3 (3-0) f s**
An analysis of major developments in American history, with American history considered as part of the historical development of modern western civilization.

HI 301, 302 AMERICAN ECONOMIC HISTORY **3 (3-0) f s**
A history of economic institutions and customs in the United States from the time of the transfer to the New World of European economic customs to the present. The course divides at 1860. The semesters may be taken separately.

HI 306 NORTH CAROLINA HISTORY **2 (2-0) s**
The political, social and economic developments of North Carolina from colonial beginnings to the present.

HI 331 THE OLD SOUTH **3 (3-0) f**
The intellectual and cultural history of the Old South and of ante-bellum society from the end of the colonial period to the Civil War.

HI 332 THE NEW SOUTH **3 (3-0) s**
A study of the political, economic and social developments in the South from the Civil War to the present.

HI 333 AMERICAN AGRICULTURAL HISTORY **3 (3-0) f**
Historical developments of agricultural activity in the United States from the transfer of western European agriculture to America to the present, with particular emphasis on the historical place and importance of agriculture in American life.

HI 367 MODERN WESTERN ECONOMIC HISTORY **3 (3-0) s**
A treatment of the historical development of the economic customs and institutions of the western world during the modern period, beginning with the Commercial Revolution.

HI 375 LATIN AMERICA **3 (3-0) s**
Prerequisite: HI 205 or HI 252 or an acceptable substitute.
A study of the main currents of Latin American development from 1492 to the present day. The histories of leading countries including Brazil, Argentina, Colombia, Peru and Mexico will be emphasized to show political, economic and social trends as experienced during the conquest, colonization and independence, and, especially, the national period since 1830.

HI 401 RUSSIAN HISTORY **3 (3-0) f**
This course presents the major trends in Russian social, political, economic and cultural history, with emphasis on the nineteenth and twentieth centuries. USSR policy is studied in relation to the full sweep of Russian history.

HI 402 ASIA AND THE WEST **3 (3-0) s**
A history of Asia from the mid-nineteenth century to the present, with emphasis on Asian nationalism and conflict with the imperial powers.

HI 409 COLONIAL AMERICA **2 (2-0) f**
A study of the development of the American colonies in the seventeenth and eighteenth centuries, with special emphasis on European backgrounds.

HI 412 RECENT UNITED STATES HISTORY **3 (3-0) f s**
A study of the main currents in American political, economic, social and diplomatic history of the twentieth century.

HI 415 INTERNATIONAL RELATIONS SINCE 1870 **3 (3-0) s**
Prerequisite: HI 205 or an acceptable substitute
A study of the relations between the major countries of the world since 1870. In addition to the history of actual diplomatic relations, crises and settlements, attention is given to the causes of the various international crises. The course also includes study of the development of international organizations and the various points of conflict between international law and organization and the sovereignty of independent governments.

HI 422 HISTORY OF SCIENCE **3 (3-0) s**
A study of the evolution of science from antiquity to the present with particular attention given to the impact of scientific thought upon selected aspects of western civilization. The course provides a broad perspective of scientific progress and shows the interrelationship of science and major historical developments.

HI 461 THE SOVIET UNION (Same as EC, PS 461) **3 (3-0) f**
Prerequisites: One semester of Economics and Political Science 201 or History 205 or acceptable substitute
An analysis of the structure and function of the major Soviet economic, political and social institutions with special stress on the historical roots and continuity of Russian civilization. The course is presented in three equal phases of approximately five weeks each, covering Russian history, Soviet government, and Soviet economy.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

HI 534 (SAME AS RS 534) FARMERS' MOVEMENTS **3 (3-0) s**
Prerequisite: 3 credits in American history, American government, sociology or a related social science
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.

Mr. Noblin

COURSES IN POLITICAL SCIENCE FOR UNDERGRADUATES

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 is given to other types of political systems, and comparisons are made where relevant throughout the course.

PS 202 COUNTY AND MUNICIPAL GOVERNMENT **3 (3-0) f s**
This course examines the principal types of county and city government and the functions performed by counties and cities including functional relationships with the state and national governments.

PS 301 COMPARATIVE POLITICAL SYSTEMS **3 (3-0) f**
An analytical study of the federal and unitary systems and the presidential, parliamentary and authoritarian plans of government, with special attention to the governments of the United Kingdom, France, Germany, Italy and the Soviet Union.

PS 302 CONTEMPORARY WORLD POLITICS **3 (3-0) f s**
A study of the pattern of international life, the instruments of national policy, the controls upon international behavior and the major problems in international relations since World War II, including the development of the United Nations and various regional arrangements. Attention is given to the national interests and foreign policies of the states belonging to the Western and Soviet blocs, with emphasis on the position of the United States.

HORTICULTURE

PS 401 AMERICAN PARTIES AND PRESSURE GROUPS **3 (3-0) f s**
After a brief survey of those features of American government essential to an understanding of the political process, the course proceeds to examine the American electorate and public opinion and devotes its major attention to the nature, organization and programs of pressure groups and political parties and to their efforts to direct opinion, gain control of government and shape public policy. Special attention is given to party organization and pressure group activity at the governmental level and to recent proposals to improve the political party as an instrument of responsible government.

PS 406 PROBLEMS IN NORTH CAROLINA GOVERNMENT **2 (2-0) s**
Prerequisite: PS 201 or an acceptable substitute
Selected problems arising from the operation of the legislative, administrative and judicial machinery in North Carolina. In addition to acquiring a comprehensive view of these problems each student will make an intensive study of a special phase of one of them.

PS 461 (Same as EC, HI 461) THE SOVIET UNION

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PS 501 MODERN POLITICAL THEORY **3 (3-0) f**
Prerequisite: PS 201 or HI 205 or an acceptable substitute
A study of the state and its relationship to individuals and groups, approached through the reading of selected passages from the works of outstanding philosophers from the sixteenth century to the present.

Mr. Holtzman

PS 502 PUBLIC ADMINISTRATION **3 (3-0) f**
Prerequisite: PS 201 or PS 202 or an acceptable substitute.
A study of the principles and problems of administration in a democracy, including such matters as organization, personnel, fiscal management, relationship to the legislative and judicial functions, control of administrative agencies and policies and public relations.

Mr. Block

PS 503 INTERNATIONAL ORGANIZATION **2 (2-0) s**
Prerequisite: PS 201 or HI 205 or an acceptable substitute
A study of the evolving machinery and techniques of international organization in the present century with particular emphasis on recent developments. The actual operation of international organization will be illustrated by the study of selected current international problems.

Graduate Staff

PS 512 AMERICAN CONSTITUTIONAL THEORY **3 (3-0) s**
Prerequisite: PS 201 or an acceptable substitute.
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.

Mr. Edsall

HORTICULTURE

COURSES FOR UNDERGRADUATES

HRT 201, 202 WOODY PLANTS **3 (1-4) f s**
Distribution, identification, adaptation, culture and use of ornamental trees, shrubs and vines in landscape planting.

Mr. Randall

HRT 212 HERBACEOUS PLANTS** **2 (0-4) s**
Distribution, identification, adaptation, culture and use of ornamental herbaceous perennial and annual plants in landscape planting.

Mr. Randall

HRT 222 INTRODUCTION TO HORTICULTURE **3 (3-0) f s**
To give the student a general concept of the nature, importance, distribution and utilization of horticultural crops and a general understanding of the principles underlying the production of fruits, ornamentals and vegetables.

Mr. Gardner

** Offered 1959-60 and in alternate years.

HRT 301 PLANT PROPAGATION **3 (2-2) f s**
Prerequisite: BO 101
A study of principles, methods and practices in seedage, cuttage, division, budding, grafting and other methods of plant propagation.

Mr. Randall

HRT 311 NURSERY PRACTICE** **3 (2-2) f**
Prerequisite: BO 101
The principles and practice involved in the production, management and marketing of nursery plants.

Mr. Randall

HRT 321 GRADING, PACKING AND INSPECTION OF FRUITS AND VEGETABLES **3 (2-3) f**
Prerequisite: BO 101
A detailed study of U. S. grades and standards for the principal fruit and vegetable crops. Practice in grading, packing, and variety identification. A course designed to prepare the student for work in the Federal-State inspection service. Field trips are required.

Mr. Gardner

HRT 331* FLORAL DESIGN AND SHOP MANAGEMENT **3 (1-5) f**
Principles and practices of flower shop management including the art of floral design.

Mr. Randall

HRT 342 LANDSCAPE GARDENING **3 (2-3) s**
The application of principles of design to landscaping the home grounds. The identification, propagation, use and maintenance of ornamental plants and lawn grasses in improving the home grounds.

Mr. Randall

HRT 412 OUTDOOR PRODUCTION OF FLORAL CROPS** **3 (2-3) s**
Prerequisites: BO 102, SOI 200 (or concurrently)
Principles, methods and practices in commercial production of floral crops out-of-doors.

Mr. Randall

HRT 421 FRUIT PRODUCTION **3 (2-3) f**
Prerequisites: BO 102, SOI 200 (or concurrently)
Methods of production of the principal tree and small fruits. This is designed to give an understanding of the practices involved in fruit production.

Messrs. Correll, Walker

HRT 432 VEGETABLE PRODUCTION **3 (2-3) f s**
Prerequisites: BO 102, SOI 200 (or concurrently)
Soil preparation, seedage, plant production, fertilization, irrigation, pest control and general culture of vegetable crops.

Messrs. Miller, McCombs

HRT 441* COMMERCIAL FLORICULTURE **3 (2-2) f**
Prerequisites: BO 102, SOI 200 (or concurrently)
Greenhouse construction, heating and management.

Mr. Randall

HRT 442* COMMERCIAL FLORICULTURE **3 (2-2) s**
Prerequisite: HRT 441
Botanical characters, importance, propagation, culture and preparation for market of the floral crops commonly grown in the greenhouse.

Mr. Randall

HRT 452 PRINCIPLES OF FRUIT AND VEGETABLE PROCESSING **3 (2-2) s**
Prerequisite: BO 102
Principles and methods involved in the preservation of fruits and vegetables, with emphasis placed on canning and freezing.

Mr. Jones

HRT 462 GRADING AND INSPECTION OF PROCESSED FRUITS AND VEGETABLES **2 (1-2) s**
Prerequisite: Registration by permission of the instructor
Methods of inspection, grading and critical appraisal for quality of the principal fruit and vegetable products.

Mr. Hoover

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* Offered 1958-59 and in alternate years.
** Offered 1959-60 and in alternate years.

HORTICULTURE

HRT 481 BREEDING OF HORTICULTURAL PLANTS **3 (2-2) f**
Prerequisite: GN 411
The application of genetics and plant breeding to the improvement of horticultural crops.
Mr. Haynes

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

HRT 501 HORTICULTURE PROBLEMS **Credits by Arrangement**
Prerequisite: BO 421 or GN 411 and permission of instructor
Investigation of a problem in horticulture, each student selecting a problem and conducting the investigation under the direction of the instructor. The problem may last one or two semesters. Credits will be determined by the nature of the problem, not to exceed a total of 4 hours.
Graduate Staff

HRT 512* HANDLING AND STORAGE OF ORAMENTAL PLANTS **3 (2-2) s**
Prerequisite: BO 421
A study of the handling and storage of ornamental plants and plant parts. Consideration will be given to the chemical and physiological changes occurring in storage, storage facilities, materials and methods for handling and storing these products.
Mr. Gartner

HRT 521, 522 TECHNOLOGY OF FRUIT AND VEGETABLE PRODUCTS **3 (2-2) f s**
Prerequisite: BO 312 (or concurrently)
Comprehensive treatment of principles and methods of preservation of fruits and vegetables, including small scale plant operation and commercial processing plant visits.
Mr. Jones

HRT 532 ADVANCED FRUIT PRODUCTION** **4 (3-3) s**
Prerequisites: HRT 421, BO 421 (or concurrently)
A comprehensive stuty of principles involved in production of tree and small fruits.
Mr. Walker

HRT 541 (GN 541 or FC 541) PLANT BREEDING METHODS **3 (3-0) f**
Prerequisites: GN 512; ST 511 Recommended
An advanced study of methods of plant breeding as related to principles and concepts of inheritance.
Messrs. Haynes, Mann

HRT 542 (GN 542 or FC 542) PLANT BREEDING FIELD PROCEDURES **2 (0-4) s**
Prerequisites: HRT 541, or FC 541 or GN 541
Laboratory and field study of the application of various plant breeding techniques and methods used in the improvement of economic plants.
Messrs. Haynes, Mann

HRT 562 HANDLING AND STORAGE OF FRUITS AND VEGETABLES** **3 (2-2) s**
Prerequisite: BO 421
The chemical and physiological changes occurring during handling and storage of fruits and vegetables. Consideration will also be given to facilities for handling and storage.
Mr. McCombs

HRT 571* ADVANCED VEGETABLES CROPS **3 (3-0) f**
Prerequisites: BO 421 (or concurrently) and consent of instructor
A study of the origin, distribution, botanical relationships and basic principles of production of the major vegetable crops.
Mr. Cochran

HRT 581 SENIOR SEMINAR **1 (1-0) f s**
Prerequisite: Senior in Horticulture
Presentation of scientific articles, progress reports in research, and special problems in horticulture and related fields.
Mr. Gardner

COURSES FOR GRADUATES ONLY

HRT 601 ADVANCED OLERICULTURE **3 (3-0) f**
Prerequisite: HRT 571
A study of a specific technical problem, involving original investigation, including a survey of pertinent literature, or an exhaustive study of literature on a given subject or plant.
Mr. Cochran

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* Offered 1958-59 and in alternate years.
** Offered 1959-60 and in alternate years.

HRT 602 ADVANCED ORNAMENTAL HORTICULTURE **3 (3-0) s**

Prerequisite: BO 421, HRT 442
A study of specific problems in ornamental crops, either through a review of pertinent literature or by an original investigation.

Mr. Gartner

HRT 612 ADVANCED FRUIT AND VEGETABLE PROCESSING **3 (3-0) s**

Prerequisite: HRT 522 or equivalent
Critical study of certain processing methods as applied to fruit and vegetable preservation.

Mr. Jones

HRT 621* METHODS AND EVALUATION OF HORTICULTURAL RESEARCH **3 (3-0) f**

Prerequisite: BO 421, ST 511 (or concurrently)
Methods and techniques in the field of horticulture and their application in the solution of current problems. Critical evaluation of published papers reporting results of horticultural experiments. Methods of compiling data and presenting results.

Mr. Cochran

HRT 632 ADVANCED POMOLOGY **3 (3-0) s**

Prerequisite: HRT 532 or equivalent
A critical study of specific problems in fruit crops including current literature.

Mr. Walker

HRT 641 RESEARCH **Credits by Arrangement**

Prerequisite: Graduate standing in Horticulture—consent of instructor
Original research on specific problems in fruit, vegetable or ornamental crops, or in fruit and vegetable processing. Thesis prepared should be worthy of publication. A maximum of six credits is allowed toward the Master of Science degree; no limitation on credits in Doctorate program.

Graduate Staff

HRT 651 SEMINAR **1 (1-0) f s**

Prerequisite: Graduate standing
Presentation of scientific articles, progress reports in research, and special problems in Horticulture and related fields. Presentation of one or more papers each semester is required.

Graduate Staff

INDUSTRIAL AND RURAL RECREATION

COURSES FOR UNDERGRADUATES

REC 152 INTRODUCTION TO RECREATION **3 (2-2) f s**

This course is designed to provide instruction in the following areas: 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; recreation leadership; activities and program planning; and tournament planning and administration. The course is of lecture-laboratory technique.

Mr. Stott

REC 153 AQUATIC SPORTS **2 (0-4) f s**

A laboratory course includes: the history of the techniques and methods of teaching swimming, modern methods of teaching diving, officiating, games, pageants, the use of small craft, life-saving techniques, principles of water safety, the organization and administration of water safety programs and the maintenance of the swimming pool and water front.

Staff

REC 201 PLAYGROUND LEADERSHIP **2 (1-3) f s**

This course is designed to present to the student play activities of an active, semi-active, and quiet nature so that a selection can be made to fit a playground situation. Special emphasis is placed on the learning of low organized games, contests, relays and water activities and their practical application in an actual playground program. Stress is placed on the principles, techniques and tools of effective playground leadership.

Mr. Miller

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* Offered 1958-59 and in alternate years
** Offered 1959-60 and in alternate years

INDUSTRIAL AND RURAL RECREATION

REC 203 INDIVIDUAL CORRECTIVE PHYSICAL EDUCATION **2 (2-0) f**
The problems underlying the need for an individual physical education program for handicapped students are discussed. The primary emphasis will be on the organization and administration of the individual physical education program in schools and colleges; the formulation of individual programs of physical education for the most prevalent types of disabilities found in the school population and the techniques necessary for effective accomplishment of the objectives of the program.

Mr. Crawford

REC 204 METHODS AND MATERIALS IN HEALTH EDUCATION **2 (2-0) s**
A consideration of the most appropriate content and methods which should be in high school health education programs. Sources of materials are stressed. Public relations are studied.

Mr. Miller

REC 205 METHODS AND MATERIALS IN PHYSICAL EDUCATION **2 (2-0) f**
Presents critical studies of methods of instruction and procedures in supervision applicable to physical education. Provides observation in the required physical activity-service courses.

Mr. Hines

REC 207 HISTORY AND PRINCIPLES OF PARK ADMINISTRATION **2 (2-0) f s**
This course includes the study of the history, present status and the basic principles of operation of parks and park systems in America.

Mr. Stott

REC 251 SOCIAL RECREATION I **3 (0-6) f s**
This course presents material and information needed for conducting social play in the home, church, club, camp, on the playground and in the recreation center. It emphasizes the place of the leader in recreation music and drama. Stress is placed on the acquiring of technical knowledge of social activities, including rhythmics and square dancing, and the conducting of specific types of activities.

Mr. Crawford

REC 252 SOCIAL RECREATION II **3 (0-6) f s**
Prerequisite: REC 251
A laboratory course is designed to develop leadership skills in recreation dramatics and music. Dramatic areas to be considered are: acting, children theatres, choral speaking, creative drama, play production, puppetry, story telling and stage design and equipment. Activities in recreation music will include: singing, playing, rhythmic movement, song creation and combined activities. Outside studies and assigned readings with reports are required.

Mr. Crawford and visiting instructors

REC 253 PRINCIPLES OF PHYSICAL EDUCATION **3 (2-2) f s**
This course is designed to give the student a professional orientation in physical education and the place of physical education activities in allied and related fields. It introduces the student to the program of physical education—its interpretation in the light of present day needs, its sociological basis, aims and objectives and a sampling of program activities. In the laboratory period stress is placed on the learning of skills and coaching techniques involved in executing and directing the simplest to the most complex type of activities performed on mats and gymnasium apparatus.

Mr. Miller

REC 301 ORGANIZATION AND ADMINISTRATION OF PHYSICAL EDUCATION **2 (2-0) f s**
This course is designed to prepare students to meet the problems of organization and administration of physical education with the view in mind of making suitable adaptation to various related fields. It presents the solution to many of the problems facing the administrator and teacher in organizing and administering a physical education program with analogous comparisons of these problems to other areas in the field of recreation. The course is intended as a practical approach and a background for the student going into the physical activity field where problems of organization and administration assume major proportions in this area of work.

Mr. Miller

REC 315 PREVENTION AND CARE OF ATHLETIC INJURIES **2 (2-0) f s**
Prerequisite: ZO 213 or its equivalent
This course is designed for students in residence and for individuals in-service. Directors of community centers, boys clubs, coaches of athletic teams, athletic directors and others are confronted constantly with: the prevention and the care of athletic injuries. The course is of lecture-laboratory technique.

Mr. Crawford

REC 325 ACTIVITIES FOR THE HANDICAPPED INDIVIDUAL **2 (2-0) f s**
This course provides students with methods that will motivate the atypical individual to improve not only his physical condition but also his outlook on life. To utilize modern educational principles and sport activities which will satisfy the handicapped individual's needs, interest and capacity. To provide sources of information applicable to the problem. Outside studies and assigned readings with reports are required.

Mr. Crawford

REC 331 SCHOOL CAMPING **2 (1-2) f s**
This course covers the history of school camping and outdoor education. The purpose of this course is to provide the student with the methods and techniques in planning the school camp program so as to furnish a laboratory experience in those areas of study that can best be learned in the out-of-doors. Practical consideration will be given to the preplanning of school camping experiences.

Mr. Stott

REC 333 FIRST AID AND SAFETY **2 (1-2) f s**
This course stresses first aid and safety education in relation to the home, school and community. It strongly emphasizes safety principles as applied to activities of the gymnasium, playgrounds and athletic fields. Laboratory will provide practice in first aid skill.

Mr. Stott

REC 351 INDIVIDUAL SPORTS IN RECREATION **3 (0-6) f s**
Prerequisite: Completion of Physical Education requirement or equivalent
The course provides for group instruction and laboratory experiences in the following sports: archery, bowling, golf, handball, tennis, table tennis, bait and fly casting, badminton and squash. Problems involved in starting and conducting a program of individual sports organized on a mass basis and designed to serve the interest of all people are studied. Officiating techniques applicable to individual sports are utilized. The course is of laboratory character, and study of the professional problems involved with assigned readings and reports is required.

Mr. Crawford

REC 352 TEAM SPORTS IN RECREATION **3 (0-6) f s**
Prerequisite: Completion of Physical Education requirement or equivalent
The course provides for group instruction and laboratory experiences in the following games: football, basketball, baseball, volleyball and speedball. Problems involved in starting and conducting a program of group games organized on a mass basis designed to serve the interests of all people are studied. Officiating techniques applicable to the various games are utilized. The course is of laboratory character, and study of the professional problems involved with assigned readings and reports is required.

Mr. Crawford

REC 353 CAMP ORGANIZATION AND LEADERSHIP **3 (2-2) f s**
This course surveys the development of organized camping and the educational, health, and recreational objectives of camping. Program planning and leadership training in community, private, agency and school camping is emphasized. Laboratory will provide practice in campcraft skills.

Mr. Stott

REC 354 PERSONAL AND COMMUNITY HYGIENE **3 (3-0) f s**
This course presents the essential present-day knowledge of personal and community health. Emphasis is placed upon health problems, disease prevention, communicable diseases and their control, public health administration, school and industrial hygiene and various other health problems confronting the individual and the community. The course presents valuable and interesting health information to college men and women in order that they might live more intelligently in terms of newer health concepts and also be better prepared to assume their responsibilities as citizens of their respective communities.

Mr. Miller

COURSES FOR ADVANCED UNDERGRADUATES

REC 401 PRINCIPLES AND PRACTICES OF INDUSTRIAL RECREATION **2 (2-0) s**
A study of existing programs of industrial recreation, their operation, methods of finance, scope and problems is emphasized. Relationship of industrial recreation to other programs of recreation is studied.

Mr. Hines

REC 404 PRINCIPLES AND PRACTICES OF RURAL RECREATION **2 (2-0) s**
A study of the organization and administration of rural recreation programs and facilities. Emphasis on planning programs of recreational activities for the rural community, the county-wide program, clubs and organizations. Study of existing programs of rural recreation, their operation and their problems will receive major attention.

Mr. Hines

INDUSTRIAL AND RURAL RECREATION

REC 411 PARK MAINTENANCE AND OPERATION I **2 (1-2) f s**

Prerequisite: Senior status
This course deals with: methods of operation of various park facilities for public use; interpretative and public use programs; information and education; park personnel administration; and protection and law enforcement.

Mr. Stott

REC 412 PARK MAINTENANCE AND OPERATION II **2 (1-2) f s**

Prerequisite: REC 411
This course will begin with a one-week tour of various types of parks and park systems. The following subjects would then be studied in detail: preventive maintenance, job planning and scheduling, modern maintenance techniques and maintenance materials.

Mr. Stott

REC 431 CAMPCRAFT **2 (0-4) f s**

Prerequisite: REC 353 or equivalent
This course is entirely of a laboratory nature. It is designed to provide the student with skills, and methods of teaching campcraft and woodcraft.

Mr. Stott

REC 451 FACILITIES AND EQUIPMENT **3 (0-6) f s**

This course includes the history of park and recreation facility development and trends in recreation facility planning. Emphasis is placed upon the planning principles involved in the design and layout of recreation areas and recreation buildings. Field trips will enable the student to see the various types of recreation facilities.

Mr. Stott

REC 452 RECREATION ADMINISTRATION **3 (3-0) f s**

Prerequisite: Senior status
This course deals with: the internal organization of a recreation department; financing; accounting and financial procedure; budget making and control; records, reports and filing; program planning and control; personnel policies and organization; and public relations.

Mr. Hines

REC 470 SUPERVISED PRACTICE **6 (0-18) f s**

This course is intended to provide the prospective recreation director with an opportunity to acquire experience in the skills and techniques involved in the organization and administration of recreation activities in an established program. Each student during his senior year will spend 10 weeks off-campus in a selected location. (A minimum of 225 contact hours are required.) The student will have the opportunity to observe the activities and practices of the recreation executive, to organize and conduct activities under supervision, to observe activities and practices of experienced recreation activity leaders and to observe the maintenance and operation of facilities. Prior to enrollment in this course, the student is expected to have completed the senior field trip consisting of visits to recognized programs of recreation throughout North Carolina. The student will have the opportunity to become familiar with the total recreation program.

Mr. Hines

REC 471 ORGANIZING THE RECREATION PROGRAM **2 (2-0) f s**

Prerequisite: Senior status
This course includes the types of recreation opportunities to be made available to individuals, groups or communities to be served and the methods of providing these opportunities. Activities to be considered are classified as: arts and crafts; dance; drama; games, sports and athletics; hobbies; music; outdoor recreation; reading, writing and speaking; social recreation; special events and voluntary service. The lecture-discussion technique is used. Outside studies and assigned readings with reports are required.

Mr. Hines

REC 472 OBSERVATION AND FIELD EXPERIENCE **2 (0-6) f s**

Prerequisite: Senior status
This course is designed to provide the student with the opportunity to observe, appraise and evaluate: the operation of program activities; teaching methods; administrative, supervisory and organizational techniques; procedures and conduct of advisory and commission meetings; professional conferences and society meetings. Students will be expected to complete this entire gamut. By use of field experience, the student will be expected to prepare written reports of observations. Only those experiences approved by the recreation faculty shall be accepted.

Mr. Hines

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

REC 501 SPECIAL PROBLEMS IN RECREATION **3 (2-2) f**
Prerequisites: 1. Completion of 20 hours credit in recreation courses or equivalent. 2. A "B" average in recreation courses or equivalent
A survey of specific problems in recreation. 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. Follows the seminar procedure.

Mr. Hines

— — —INDUSTRIAL ARTS AND INDUSTRIAL EDUCATION

COURSES FOR UNDERGRADUATES

IA 100 INTRODUCTION TO INDUSTRIAL ARTS **1 (1-0) f**
To assist students in their orientation to college life and to acquaint them with the scope and problems of industrial arts.

Staff

IA 103, 104 INDUSTRIAL ARTS DRAWING **3 (1-4) f s**
Practice in lettering, sketching and the use of instruments as applied to orthographic projection, pictorial drawings, sheet metal drawing, machine drawings, charts and graphs, and architectural drawing. Explanation sketches and practical working drawings. Materials and processes for drawing reproduction.

Mr. Troxler

IA 107 GENERAL WOODWORK **3 (1-4) f**
This course involves project planning, use and care of common hand tools, wood finishing, characteristics and uses of common woods, types and uses of hardware and fastners, and wood lathe turning. Experiences in some elementary wood machines with emphasis on wood lathe turning.

Mr. Ford

IA 108 GENERAL WOODWORK **3 (1-4) s**
Prerequisite: IA 107
Use of woodworking machine tools. Production and selection of projects adapted to available material and practical processes. New techniques in woodworking processes. Emphasis will be given to new tools, materials and processes in wood.

Mr. Ford

IA 203 PRACTICAL DRAFTING **2 (1-2) s**
Required of students in Wild Life and Furniture Manufacturing
The application of drawing practices for the layman. Freehand sketching and instrument drawings, lettering, pictorial representation, production sketches, template drawing, exploded views, shades and shadows. Individual problems and selected graphic representation.

Mr. Troxler

IA 205 INDUSTRIAL ARTS DESIGN **2 (1-2) f**
Prerequisites: IA 103, 104
Design and construction in a variety of industrial materials, stressing individual expression and appreciation of well designed industrial materials.

Mr. Troxler

IA 206 GENERAL METALWORK **3 (1-4) f**
Basic operations and processes in bench metal, foundry, arc and acetylene welding, metal lathe and art metalwork, and a study of metals including their properties and uses.

Mr. Massey

IA 207 GENERAL METALWORK **3 (1-4) s**
Basic operations and processes in sheet metal, forging, lathe work, milling machine, shaper work, precision grinding, and a study of the mass production techniques.

Mr. Massey

IA 215 SHEET METAL **1 (0-2) f**
Prerequisite: ME 102
A course designed to give students in the Heating and Air Conditioning curriculum of the Mechanical Engineering Department practical experience in sheet metal process, tools, operations, machines, and materials pertaining to duct work.

Mr. Massey

IA 230 HOME MECHANICS **2 (1-2) f s**
A course designed to provide information and experience in tools, materials and processes essential in the care, maintenance, and the repair of a home and home equipment. Emphis will be placed on the development of "handy man" abilities.

Staff

INDUSTRIAL ARTS

IA 304 GENERAL SHOP ORGANIZATION **2 (1-2) f**
Prerequisites: IA 104, 108, 207
This course is designed to help the student in teacher education to select, develop and organize subject matter suitable for the general shop and to provide understanding of the place of the general shop in the public schools.
Mr. Hostetler

IA 306 GRAPHIC ARTS **3 (1-4) s**
A course designed to give the student experience in the basic operations and processes and to provide related information in letterpress printing, block printing, silk screen printing, book binding, offset printing and photography.
Mr. Ford

IA 307 GENERAL ELECTRICITY **3 (1-4) f**
The fundamentals of electricity as applied to magnetism, electromagnetism, heat and power will be emphasized. Repair of common household appliances and the construction of well made electrical projects are required.
Mr. Young

IA 308 INDUSTRIAL ARTS ELECTRONICS **3 (1-4) s**
This course includes the fundamentals of electricity as applied to electronics. Emphasis in the course is placed on a study of the various applications of the vacuum tubes, especially radio communications along with a study of semi-conductors.
Mr. Young

IA 314 RECREATIONAL ARTS AND CRAFTS **2 (1-2) s**
Required of juniors in Industrial and Rural Recreation; elective for others
A course designed to give students interested in recreational work an understanding of and experiences in different types of arts and crafts. Emphasis will be given to a wide variety of crafts as adaptable to camps, city, industrial and institutional programs.
Staff

IA 315 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.
Mr. Hostetler

IA 320 TOOLS AND MATERIALS **2 (1-2) f**
A study of the care and maintenance of hand and machine tools and of the sources, manufacture, characteristics, uses and costs of industrial materials and products.
Mr. Troxler

IA 321 METALWORK TECHNOLOGY **2 (1-2) f s**
Prerequisites: IA 206, 207 or equivalent
This course is designed to give the student additional theory and skills in metalworking operations and processes. Emphasis will be on the metal lathe, metal shaper and milling machine.
Mr. Massey

ED 100 INTRODUCTION TO INDUSTRIAL EDUCATION **2 (2-0) f**
The place of vocational education in a program of public education and the fundamental principles upon which this work is based.

ED 422 METHODS OF TEACHING INDUSTRIAL SUBJECTS **4 (4-0) s**
Prerequisites: ED 344, PSY 304
A study of effective methods and techniques of teaching industrial subjects. Emphasis is given to class organization; student-teacher planning; methods of teaching manipulative skills and related information; lesson planning; shop safety; and evaluation. Teaching problems will be studied and analyzed following directed observations in the public schools.
Mr. Hostetler

ED 440 VOCATIONAL EDUCATION **2 (2-0) f**
Prerequisites: ED 344, PSY 304
A comprehensive study of the types of vocational education of less than college grade, provided for through Federal legislation; an evaluation of the effectiveness of the program; and a detailed study of the North Carolina Plan.
Staff

ED 444 STUDENT TEACHING IN INDUSTRIAL SUBJECTS **6 (2-15) f**
Prerequisite: ED 422
Students in the Industrial Arts and Industrial Education curricula will devote ten 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.
Staff

IA 460 GENERAL SHOP **3 (1-4) s**
Prerequisite: ED 444 or permission of instructor
A course designed to give the student the opportunity to strengthen weakness both in skills and teaching methods which became apparent during his term of student teaching. Emphasis will be given to the organization, administration, content and methods of the general shop. Opportunity will also be given to develop good general shop project ideas.
Mr. Hostetler

ED 482 CURRICULUM PROBLEMS IN INDUSTRIAL ARTS **2 (1-2) f**
Prerequisites: PSY 304 or six credits in Education
Approximately one-third of the course is directed to developing a working philosophy of industrial arts and the major portion of the course is devoted to planning and organizing learning units in industrial arts.
Mr. Young

ED 483 INSTRUCTIONAL AIDS AND DEVICES **2 (1-2) f**
Prerequisites: PSY 304 or six credits in Education
Analysis of learning units and the preparation of instructional aids and devices.
Messrs. Hostetler, Young

IA 484 SCHOOL SHOP PLANNING AND EQUIPMENT SELECTION **3 (3-0) s**
A course for advanced undergraduate students
The physical planning of school shops and laboratories; selection of tools and equipment. Whenever possible, actual or contemplated school buildings will be used for class work.
Mr. Hostetler

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

IA 510 DESIGN FOR INDUSTRIAL ARTS TEACHERS **3 (1-4)**
Prerequisites: 6 hours of Drawing and IA 205 or equivalent
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

ED 516 COMMUNITY OCCUPATIONAL SURVEYS **2 (2-0) s**
Prerequisites: Six credits in Education and consent of instructor
Methods in organizing and conducting local surveys and evaluation of findings in planning a program of vocational education.
Graduate Staff

ED 521 ORGANIZATION OF RELATED STUDY MATERIALS **2 (2-0) f s**
Prerequisite: ED 422
The principles of selecting and organizing both technical and general related instructional material for trade extension and diversified occupations classes.
Graduate Staff

ED 525 TRADE ANALYSIS AND COURSE CONSTRUCTION **2 (2-0) f**
Prerequisites: ED 344, PSY 304
Principles and practices in analyzing occupations for the purpose of determining teaching content. Practice in the principles underlying industrial course organization based on occupational analysis covering instruction in skills and technology and including course outlines, job sequences, the development of industrial materials and instructional schedules.
Graduate Staff

ED 527 PHILOSOPHY OF INDUSTRIAL EDUCATION **2 (2-0) s**
Prerequisites: ED 344, PSY 304
A presentation of the historical development of industrial education; the philosophy of vocational education; study of Federal and State legislation pertaining to vocational education; types of programs, trends and problems.
Graduate Staff

ED 528 PRINCIPLES AND PRACTICES IN DIVERSIFIED OCCUPATIONS **2 (2-0) f s**
Prerequisite: ED 422
A study of the development, the objectives, and principles of diversified occupations. The organization, promotion and management of programs in this area of vocational education.
Graduate Staff

ED 552 INDUSTRIAL ARTS IN THE ELEMENTARY SCHOOL **3 (1-4) summer**
See description on page 202.

INDUSTRIAL ARTS

IA 570 LABORATORY PROBLEMS IN INDUSTRIAL ARTS **A maximum of 6 credits**

Prerequisites: Senior standing and permission of instructor
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, or ceramics.

IA 575 SPECIAL PROBLEMS IN INDUSTRIAL ARTS **A maximum of 6 credits**

Prerequisite: One term of student teaching or equivalent
The purpose of these courses is to broaden the subject matter experiences in the areas of industrial arts. Problems involving experimentation, investigation and research in one or more industrial arts areas will be required.

Graduate Staff

IA 580 MODERN INDUSTRIES **2 (2-0) s**

Prerequisites: Twelve credits in Industrial Arts and consent of the instructor
Elective course for advanced undergraduate and graduate students in industrial arts. Designed to assist teachers in guiding students to sources of information relative to various modern industries.

Mr. Young

ED 595 INDUSTRIAL ARTS WORKSHOP **3 (3-0) summer**

Prerequisite: One or more years of teaching experience
A course for experienced teachers, administrators and supervisors of industrial arts. The primary purpose will be to develop sound principles and practices for initiating, conducting and evaluating programs in this field. Enrollees will pool their knowledge and practical experiences and will do intensive research work on individual and group problems. (Offered in Summer School Only)

Mr. Hostetler

COURSES FOR GRADUATES ONLY

ED 610 ADMINISTRATION AND SUPERVISION OF VOCATIONAL EDUCATION **2 (2-0) f s**

Prerequisites: PSY 304, ED 344, 420, 440, or equivalent
Administrative and supervisory problems of vocational education; practices and policies of Federal and State offices; organization and administration of city and consolidated systems.

Graduate Staff

ED 614 MODERN PRINCIPLES AND PRACTICES IN SECONDARY EDUCATION **2 (2-0) f s**

Prerequisite: Twelve hours in Education
Foundations of modern programs of secondary education; purposes, curriculum, organizing, administration, and the place and importance of the high school in the community in relation to contemporary social force.

Graduate Staff

ED 619 SEMINAR IN INDUSTRIAL ARTS EDUCATION **1-1**

Prerequisite: Graduate standing
Reviews and reports on special topics of interest to students in industrial arts education.

Mr. Hostetler

ED 624 RESEARCH IN INDUSTRIAL ARTS EDUCATION **A maximum of 6 credits**

Prerequisites: Eighteen credits in Education and permission of instructor
The student will be guided in the selection of one or more research problems and in the organization of the problems, methods of gathering data, procedure for analyzing data, and best practice for interpreting and reporting data.

Mr. Hostetler

ED 627 RESEARCH IN INDUSTRIAL EDUCATION **A maximum of 6 credits**

Prerequisites: Eighteen credits in Education and permission of instructor
The student will be guided in the selection of one or more research problems and in the organization of the problems, methods of gathering data, procedure for analyzing data, and best practice for interpreting and reporting data.

Graduate Staff

ED 630 PHILOSOPHY OF INDUSTRIAL ARTS **2 (2-0) f s**
Prerequisite: Twelve hours in Education
Required of all graduate students in Industrial Arts Education
Current and historical developments in industrial arts; philosophical concepts, functions, scope, criteria for the selection and evaluation of learning experiences, laboratory organization, student personnel programs, community relationships, teacher qualifications, and problems confronting the industrial arts profession.

Mr. Hostetler

ED 635 ADMINISTRATION AND SUPERVISION OF INDUSTRIAL ARTS **2 (2-0) f s**
Prerequisite: Twelve hours in Education
A study of the problems and techniques of administration and supervision in the improvement of industrial arts in the public schools. Selection of teachers and their improvement in service and methods of evaluating industrial arts programs.

Mr. Hostetler

— — — — — — — — — — INDUSTRIAL ENGINEERING

IE 201 INDUSTRIAL ENGINEERING I **3 (3-0) f s**
Prerequisite: Sophomore standing
An intensive and integrated study of the factory as a producing unit. History of manufacturing; organization structure; analysis of products; establishment and evaluation of processes; motion study; plant layout, production planning, scheduling and control. Course will include solution of case problems and plant visits.

IE 202 INDUSTRIAL ENGINEERING II **3 (3-0) f s**
Prerequisite: IE 201
Continuation of IE 201.

IE 217 MACHINE TOOLS **1 (0-2) f s**
Prerequisite: Sophomore standing
One session two hours each week consisting of lecture, demonstrations and student projects. Dimensional control, press forming, power cutting of metals including turning, milling, shaping and finishing. Selection and use of cutting tools, speeds and feeds.

IE 218 METAL FORMING **1 (0-2) f s**
Prerequisite: Sophomore standing
One session two hours each week consisting of lecture, demonstrations and outside assignments. Survey of: metals, pattern making, foundry practice, die and permanent mold casting, forging, gas cutting, gas and arc welding.

IE 224 WOOD WORKING EQUIPMENT **3 (2-3) s**
Classwork covers the description of cutting, sanding and assembly equipment and an explanation of the type of operation done by each kind of equipment. The theory of cutting and sanding and cutterhead and saw design are covered. Laboratory work consists of setting up, operating and maintaining typical furniture production equipment supplemented by visits to furniture plants.

IE 241 WELDING LABORATORY **1 (0-3) f s**
Prerequisite: IE 218 or permission of instructor
A study of mechanization as applied to oxygen cutting, to the various types of shielded metal arcs and to gas welding. Jigs, fixtures and positioners. Selection of welding process. Joint design and welding costs. Welds and stress distribution.

IE 269 WELDING AND PIPE SHOPWORK **1 (0-3) f s**
Required of sophomores in Heating and Air Conditioning
Fundamentals of welding, both arc and gas, cutting equipment; safety in the use of equipment; application of low temperature and non-ferrous alloys; cutting, threading, reaming and erection of iron pipe; copper tubes and fittings in heating and air conditioning work.

IE 301 ENGINEERING ECONOMY **2 (2-0) f s**
Prerequisite: Junior standing
Economics of industrial enterprises. Evaluation of alternatives. Time value of money. Concepts of incremental cost and economic break-even point. Capitol investment, depreciation, useful life, sunk cost. Equipment replacement and modernization. Investment criteria under conditions of uncertainty.

IE 303 INDUSTRIAL ENGINEERING III **4 (3-3) f**
Prerequisite or co-requisite: IE 202
An intensive and integrated course in methods of obtaining maximum effectiveness from the human resources used in the factory: principles of personnel administration; time study and rate setting; job evaluation and wage incentives; principles of control of labor and other costs.

IE 304 INDUSTRIAL ENGINEERING IV **4 (3-3) s**
Prerequisite: IE 303
Continuation of IE 303.

INDUSTRIAL ENGINEERING

IE 310 INDUSTRIAL SAFETY **2 (2-0) f s**

A course in the causes and prevention of industrial accidents.

IE 322 FURNITURE DESIGN AND CONSTRUCTION **2 (0-6) f**

An introduction to furniture drawing and construction. Detailed drawings and bills of material are made by the students from samples and from designers sketches. In construction, emphasis is placed upon satisfactory performance under variable atmospheric moisture, upon adequate strength and rigidity and upon low cost.

IE 326 FURNITURE MANUFACTURE AND PROCESSING **4 (3-3) s**

Prerequisite: IE 322; corequisite: IE 332

A study of the production methods of the Furniture Industry. Class work includes the production procedures from the yard through the machine, cabinet, finishing, upholstering and shipping departments. The laboratory period is supplemented by visits to furniture plants. Particular attention is paid to production rates by departments, based on number of men and supervisors, the quality of product produced and equipment used.

IE 327 FURNITURE MARKETING **2 (2-0) s**

Study of basic factors bearing on selection of ideal location, equipment and organization to serve a specific market with a specific furniture product, and selection of ideal market and product for a specific factory. In addition to lectures, each student will select one project for which he will work out a solution for correlating product and market.

IE 328 MANUFACTURING PROCESSES **3 (2-3) f**

Prerequisites: IE 217, 218

The basic processes of conversion of raw materials into producer and consumer goods. The cost reduction aspects of machine tools, jigs and fixtures in volume production. Study of industrial trends to meet needs of an expanding economy. Selected problems illustrating a wide variety of manufacturing situations.

IE 332 MOTION AND TIME STUDY **4 (3-3) f s**

Prerequisite: Junior standing

Corequisite: EC 425

Principles and techniques of motion and time study; detailed study of charting operator movements; micromotion study. Predetermined time data and its applications; stopwatch time study with emphasis on rating, allowances and standard data theory and practice.

IE 334 MOTION AND TIME STUDY **3 (0-3) f**

A course designed for non-industrial engineering students. Principles and techniques of motion and time study. Types and uses of predetermined time systems; stopwatch time study, principles and methods of rating, application of allowances and standard data.

IE 341 FURNITURE PLANT LAYOUT AND DESIGN **3 (2-3) f**

Prerequisite: IE 326

Problems in industrial plant design with special reference to furniture manufacture; building structures, equipment location, space utilization, layout for operation and control; allied topics in power utilization, light, heat, ventilation and safety. Laboratory period.

IE 343 PLANT LAYOUT AND MATERIALS HANDLING **4 (3-3) s**

Prerequisites: IE 328, IE 332

Problems in plant arrangement and layout to obtain most effective utilization of men, materials and machines as related to space and costs. Includes consideration of heat, light, ventilation, organization, control, material flow and handling, working conditions, safety and other factors as they affect the most satisfactory layout of the plant.

IE 346 FURNITURE DESIGN AND CONSTRUCTION II **2 (2-0) f**

Prerequisite: IE 322

Lecture and laboratory work on the design and construction of modern and period furniture. The course emphasizes construction features that are economical of labor and materials and are adaptable to mass production. Students are required to complete an original design and detailed drawing of a piece of furniture as one requirement of the course.

IE 401 INDUSTRIAL ENGINEERING ANALYSIS **3 (3-0) f**

Prerequisite: IE 304, MA 401, MA 405, ST 362

An introductory course in some of the more recently developed operations research techniques; applications of analysis of variance, multiple correlation and other statistical methods, queueing theory, linear programming; graphical methods of solutions; information theory and servomechanisms in Industrial Engineering. A balance will be sought between theory and practical applications.

IE 402 INDUSTRIAL ENGINEERING ANALYSIS **3 (3-0) s**
Prerequisite: IE 401
Continuation of IE 401.

IE 408 PRODUCTION CONTROL **3 (2-3) f**
Prerequisite: Senior standing
Planning, scheduling and dispatching of production in manufacturing operations; conversion of sales requirements into production orders; construction of production budgets and their relation to labor, materials and machines; laboratory project involving the development and operation of the production control system of a typical plant.

IE 425 SALES AND DISTRIBUTION METHODS **2 (2-0) s**
An analysis of the distribution of industrial and consumer products; the effect of increased productivity on sales and distribution channels; development and marketing of new products; merchandising and packaging. Sales training and sales engineering programs.

IE 430 JOB EVALUATION AND WAGE ADMINISTRATION **3 (2-3) s**
Prerequisite: Senior standing
Job analysis, classification and specification. Grading, ranking, factor comparison and point systems of job evaluation in determining equitable rates for job content. Wage surveys and merit rating. Utilization of time standards in design, installation and operation of financial incentive plans. Comparison of various wage and salary plans. Effect of wage payment methods on industrial relations practices.

IE 443 QUALITY CONTROL **3 (2-2) f**
Prerequisite: ST 361
Economic balance between cost of quality and value of quality, and techniques for accomplishing this balance. Organization for, specification and utilization of quality controls. Statistical theory and analyses as applied to sampling, control charts, tolerance determination, acceptance procedures and control of production.

IE 451, 452 SEMINAR **1 (1-0) f s**
A weekly meeting of senior students to assist the transition from a college environment to that of industry. Lectures, problems, presentation of papers and outside speakers. Employment practices and procedures useful in job finding.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

IE 515 PROCESS ENGINEERING **3 (3-0)**
Prerequisite: IE 408, 443
The technical process of translating product design into a manufacturing program. The application of industrial engineering in the layout, tooling, methods, standards, costs and control functions of manufacturing. Laboratory problems covering producer and consumer products.

IE 517 AUTOMATIC PROCESSES **3 (3-0) s**
Prerequisites: IE 408, 443
Principles and methods for automatic processing. The design of product, process and controls. Economic, physical and sociological effects of automation.

IE 519 DISTRIBUTION ENGINEERING **3 (3-0)**
Prerequisite: IE 408
The application of the Industrial Engineering principles and techniques of time study, methods analysis, materials handling, standards and controls to the field of distribution. Collection, analysis and interpretation of data and case studies in the retailing, wholesaling, transportation, warehousing and service fields.

IE 521 CONTROL SYSTEMS AND DATA PROCESSING **3 (3-0) s**
Prerequisites: IE 408, 443
This course is designed to train the student in the problems and techniques required for systematic control of the production process and the business enterprise. This includes training in the determination of control factors; the collection and recording of data; and the processing, evaluation and use of data. The course will illustrate the applications and use of data processing equipment and information machines in industrial processes. The course will train the student in the design of systems to facilitate the above requirements with most effective utilization of time, money and space. Case problems will be used extensively.

IE 543 STANDARD DATA **3 (3-0) f**
Prerequisite: ST 361 or ST 515, one course in motion and time study
Theory and practice in developing standard data from stopwatch observations and predetermined time standards; methods for estimating delays and other allowances. Problems created by correlation relationships among motions and elements. Application of standard data in cost control and production planning and scheduling.

IE 551 STANDARD COSTS FOR MANUFACTURING **3 (3-0) s**
Prerequisites: One course in accounting and one course in motion and time study
The development, application and uses of standard costs as a management tool; use of industrial engineering techniques in establishing standard costs for labor, material and overhead. Analysis of variances. Budgets as cost controls. Measures of management performance.

IE 581 PROJECT WORK **2 (0-6) f s**
Investigation and report on an assigned problem for students enrolled in the fifth-year curriculum in Industrial Engineering.
Course limited to graduate students

IE 635 PLANNING FOR PRODUCTION **3 (3-0)**
Prerequisite: IE 408, 443
A study of the factors to be considered in developing an effective and realistic plan of production for a manufacturing company; analyses of sales demands, market trends and business conditions. Construction of long range production schedules and finished good inventory controls; planning for material purchasing, equipment acquisition and labor requirements; economic and cost factors of inventory turnover rates.

IE 651, 652 SPECIAL STUDIES IN INDUSTRIAL ENGINEERING **Credits by arrangement**
The purpose of this course is to allow individual student or small groups of students to take on studies of special areas in Industrial Engineering which fit into their particular program and which may not be covered by existing industrial engineering graduate level courses. The work would be directed by a qualified staff member who had particular interest in the area covered by the problem. Such problems may require individual research and initiative in the application of industrial engineering training to new areas or fields.

IE 671, 672 SEMINAR **1 (1-0) f s**
Seminar discussion of industrial engineering problems for graduate students. Case analyses and reports.

IE 691 INDUSTRIAL ENGINEERING RESEARCH **2 to 6 f s**
Graduate research in Industrial Engineering for thesis credit.

LANDSCAPE ARCHITECTURE

COURSES FOR UNDERGRADUATES

LA 212 LANDSCAPE CONSTRUCTION I **3 (3-3) s**
The physical elements of landscape design; earth work, structures, preparation of grading and master construction plans. Design of the horizontal and vertical alignment of roads and earth work quantity estimates.

Mr. Clarke

LA 301, 302 LANDSCAPE DESIGN I, II **6 (0-12) f s**
Prerequisite: DN 202
Required of all third year students in Landscape Architecture
Landscape origination, investigation, and analysis as applied to design problems. Space concepts in area design.

Mr. Clarke

LA 311, 312 LANDSCAPE CONSTRUCTION AND MATERIALS I, II **4 (2-6) f s**
Prerequisite: DN 202
Required of all third year students in Landscape Architecture
Landscape structures, materials and land form, as a continuation and application of construction course in Civil Engineering (CE 101, 102).

Mr. Thurlow

LA 401, 402 LANDSCAPE DESIGN III, IV **6 (0-12) f s**
Prerequisite: LA 302
Required of all fourth year students in Landscape Architecture
Area design continued and related to planting and construction courses. Larger scale landscape design and site planning. Introduction to regional problems.

Mr. Clarke

LA 421, 422 PLANTING DESIGN **4 (2-6) f s**
Prerequisites: HRT 202, LA 302, 312
Required of all fourth year students in Landscape Architecture
The appraisal of plants as objects of design and their orderly arrangement for landscape effect. Techniques for recording designs, specifications, and cost estimates.

Mr. Thurlow

LA 501, 502 LANDSCAPE DESIGN V, VI **8 (0-12) f 9 (0-12) s**
Prerequisite: LA 402
Required of all fifth year students in Landscape Architecture
Area design continued. The rural and urban landscape.

Mr. Clarke

MATHEMATICS

COURSES FOR UNDERGRADUATES

MA 101 FIRST YEAR MATHEMATICS FOR ENGINEERS **5 (4-2) f s**
Rectangular coordinates, functions and graphs, linear equations and determinants, quadratic equations, inequalities, systems of equations involving quadratics, proportion and variation, binomial theorem, progressions, logarithms, exponential and logarithmic curves, trigonometric functions of general angle, derivation of trigonometric identities and formulas, the solution of plane triangles, with practical applications, slide rule.

MA 102 FIRST YEAR MATHEMATICS FOR ENGINEERS **4 (3-2) f s**
Prerequisite: MA 101
Radian measurement of angles, trigonometric curves, inverse trigonometric functions, trigonometric equations, complex numbers, theory of equations, loci of equations, the straight line, circle, parabola, ellipse, hyperbola, the general equation of second degree curve sketching, polar coordinates, parametric equations, curve fitting, coordinates in space, planes, lines and surfaces.

MA 111 ALGEBRA AND TRIGONOMETRY **4 (3-2) f s**
Exponents and radicals, fractions, quadratic equations in one and two unknowns, radical equations, logarithms, progressions, binomial theorem, solution of higher degree equations by linear interpolation, the trigonometric functions, the solution of right triangle by tables and slide rule, simple identities and equations, the oblique triangle.

MA 112 ANALYTIC GEOMETRY AND CALCULUS A **4 (3-2) f s**
A unified course, beginning with elementary ideas in analytic geometry and calculus, with the introduction of additional work in trigonometry where needed; rectangular and polar coordinate systems, fundamental locus problems, lines and conic sections, curve tracing, the derivative, with applications to geometry and simple practical problems.

MA 122 MATHEMATICS OF FINANCE AND ELEMENTARY STATISTICS **4 (3-2) f s**
Prerequisite: MA 111
Simple and compound interest, annuities and their applications to amortization and sinking fund problems, installment buying, calculation of premiums of life annuities and life insturance, elementary statistics.

MA 201 CALCULUS I **4 (3-2) f s**
Prerequisite: MA 102
A course in the fundamentals of the calculus including the formulas for differentiation and for differentials; the integrals of polynomial functions; applications to geometry, maxima and minima, areas, volumes, moments of area, work, fluid pressure; related rates, rectilinear and curvilinear motion; Newton's method of approximation of roots.

MA 202 CALCULUS II **4 (3-2) f s**
Prerequisite: MA 201
Methods of integration; definite integral with applications to length of arc, surface area, volumes, centroids and moments of inertia; Simpson's rule; indeterminant forms, infinite series, expansion of functions, hyperbolic functions, partial differentiation; multiple integration.

MA 211, 212 ANALYTIC GEOMETRY AND CALCULUS B, C **3 (2-2) f s**
Prerequisite: MA 112
An integrated course in the fundamentals of calculus, including formal differentiation and integration. Basic applications to geometry, rates, maxima and minima, areas, volumes, first and second moments and centroids are included. Additional topics from analytic geometry, not covered in MA 112, are introduced as needed as a basis for calculus.

COURSES FOR ADVANCED UNDERGRADUATES

MA 401 DIFFERENTIAL EQUATIONS I **3 (3-0) f s**
Prerequisite: MA 202
First order equations with variables separable; Euler's method of approximate solution; physical and geometrical applications. Linear equations of first order; applications. Linear equations of higher order with constant coefficients, solution by repeated linear first order equations, variation of parameters, undertermined coefficients, operators. Systems of equations; scaling variables, applications to networks and dynamical systems. Introduction to series-solutions; solutions by use of analog computer; non-linear differential equations; dimensional analysis.

MA 402 THEORY OF EQUATIONS **3 (3-0) f**
Prerequisite: MA 202 (One year of calculus)
Algebraic equations; isolation of roots, numerical approximations to roots, the Graeffe method; application of approximation procedures to transcendental equations; systems of linear equations, determinants and introduction to matrix theory.

MATHEMATICS

MA 403 FUNDAMENTAL CONCEPTS OF ALGEBRA **3 (3-0) f**
Prerequisite: MA 202 (One year of calculus)
Integers; integral domains; rational numbers; fields, rings; groups, vectors and vector spaces; linear transformations; matrices.

MA 404 FUNDAMENTAL CONCEPTS OF GEOMETRY **3 (3-0) s**
Prerequisite: MA 202 (One year of calculus)
Foundations of geometry; laws of logic; introduction to topology; affine geometry; geometric transformations; homogeneous coordinates; comparison of Euclidean and non-Euclidean Geometry.

MA 405 INTRODUCTION TO DETERMINANTS AND MATRICES **3 (3-0) f s**
Prerequisite: MA 202
Properties of determinants; differentiation; products; theorems of Laplace and Jacobi; systems of linear equations. Elementary operations with matrices; inverse rank, characteristic roots and eigenvectors. Introduction to algebraic forms.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MA 501 NUMERICAL ANALYSIS I **3 (3-0) f**
Prerequisite: MA 401
Construction of scales to represent functions and their use in the construction of networks and nomographs; theory of least squares and curve fitting, including periodic functions; interpolation formulas of Newton, Gauss, Lagrange, Bessell, and Stirling with applications to numerical differentiation and integration; the error curve and some of its applications.
Mr. Park

MA 502 NUMERICAL ANALYSIS II **3 (3-0) s**
Prerequisite: MA 501, MA 511
Analysis of errors in basic interpolation formulas; elementary difference equations; approximation by Legendre polynomials; Gaussian quadrature; various numerical methods for solving ordinary and partial differential equations.
Mr. Park

MA 511 ADVANCED CALCULUS I **3 (3-0) f s**
Prerequisite: MA 401
Continuity; Taylor's series with remainder; infinitesimals; differentials; review of convergence tests for infinite series, hyperbolic functions; partial differentiation; directional derivatives; implicit functions; Jacobians; elements of differential geometry, differentiation of integrals; improper integrals. Application to problems in engineering.
Graduate Staff

MA 511a ADVANCED CALCULUS A **3 (3-0) f**
Prerequisite: MA 202 (One year of calculus)
Sequences; continuity of functions; functions of several variables; partial differentiation and applications to maxima and minima; integration; differentiation of integrals; improper integral; Jacobians; series; gamma, beta, and error functions. Applications to problems in statistics and economics.
Graduate Staff

MA 512 ADVANCED CALCULUS II **3 (3-0) s**
Prerequisite: MA 511
Gamma and beta functions; line, surface, and space integrals; Green's theorem; Stoke's theorem; expansion of functions in Fourier series, applications to boundary value problems; introduction to the theory of functions of a complex variable, including simple mapping problems, contour integration and residue theory; elliptic integrals.
Graduate Staff

MA 514 BOUNDARY VALUE PROBLEMS **3 (3-0) f**
Prerequisite: MA 512
Ordinary homogeneous and non-homogeneous differential equations with boundary values; elements of partial differential equations; applications of Fourier series and other methods to the solutions of certain boundary value problems in partial differential equations; harmonic functions.
Mr. Mumford

MA 521 ADVANCED GEOMETRY **3 (3-0) f**
Prerequisite: MA 202 (One year of calculus)
Coordinates in space; direction angles and cosines; planes, lines, points; matrices; surfaces and curves; quadric surfaces; transformations; analysis of general equation of degree 2; matrix algebra and its applications; introduction to algebraic geometry.
Messrs. Clarkson, Nahikian

MA 522 THEORY OF PROBABILITY **3 (3-0) s**
Prerequisite: MA 401
Definitions, discrete and continuous sample spaces, combinatorial analysis, Stirling's formula, simple occupancy and ordering problems, conditional probability, repeated trials, compound experiments, Bayes' theorem, binomial, Poisson and normal distributions, the probability integral, random variables, expectation.

Messrs. Clarkson, Levine

MA 532 DIFFERENTIAL EQUATIONS II **3 (3-0) s**
Prerequisite: MA 401
Solution of second order linear equations with variable coefficients; exact equations; Green's function; singular points and series solutions; Bessel function, Legendre polynomials, and other special functions defined by ordinary differential equations; approximate methods; introduction to partial differential equations.

Graduate Staff

MA 533 HISTORY OF MATHEMATICS **3 (3-0) s**
Prerequisite: MA 202 (One year of calculus)
Elective
Evolution of the number system; trends in the devolopment of modern mathematics; lives and contributions of outstanding mathematicians.

Mr. Nolstad

MA 535 AN INTRODUCTION TO COMPUTERS **3 (3-0) f s**
Prerequisite: MA 401 and any other advanced course
The elements of number systems and commonly used machine codes; fundamental coding and programming techniques for the IBM 650. Selected problems are subjected to numerical and error analysis and solved on the IBM 650. The elements of the theory and applications of the analog computer; solutions of certain differential systems on the Donner analog computer.

Messrs. Caldwell, Tompkins

MA 541 VECTOR ANALYSIS **3 (3-0) f s**
Prerequisite: MA 401
The algebra of vectors and dyadics; elementary space geometry in vector form; scalar and vector differentiation of scalar; vector and dyadic functions; curvilinear coordinates; line, surface, and volume integrals; integral transformations; applications.

Messrs. Harrington, Winton

COURSES FOR GRADUATES ONLY

MA 602 PARTIAL DIFFERENTIAL EQUATIONS **3 (3-0) s**
Prerequisite: MA 512
Partial differentiation, functional dependence, envelopes, eliminants, Lagrange's equation, general and complete integrals, non-linear equations of first and higher orders; Fourier series with applications to problems in vibrations, heat and fluid flow, electricity; boundary value problems.

Mr. Mumford

MA 605 NON-LINEAR DIFFERENTIAL EQUATIONS **3 (3-0) f**
Prerequisites: MA 512, MA 532
Non-linear differential equations associated with important physical systems; contrasts with linear systems; use of phase plane diagrams and other geometrical methods of analysis; approximate solutions by perturbation, Fourier series, slow variations of amplitude and phase, linearized equations, and computer methods; study of limit cycles and stability.

Mr. Harrington

MA 611 COMPLEX VARIABLE THEORY AND APPLICATIONS I **3 (3-0) f**
Prerequisite: MA 512
Elementary functions; analytic functions and Cauchy-Riemann equations; conformal mapping and applications; Taylor and Laurent series; contour integration and residue theory; the Schwarz-Christoffel transformation.

Messrs. Bullock, Mumford

MA 612 COMPLEX VARIABLE THEORY AND APPLICATIONS II **3 (3-0) s**
Prerequisite: MA 611
Conformal mapping and applications to flow phenomena; multiple-valued functions and Riemann surfaces; further applications of residue theory; analytic continuation; infinite series and asymptotic expansions; elliptic functions and other special functions in the complex domain; structure of functions.

Mr. Bullock

MA 622 VECTOR SPACES AND MATRICES **3 (3-0) s**
Prerequisite: MA 511
Introduction to matrices; vector spaces; equivalence, rank, inverse or matrices; determinants; congruence; quadratic forms; polynomials over a field; similarity; characteristic roots.

Messrs. Nahikian, Park

MA 632 OPERATIONAL MATHEMATICS I **3 (3-0) f**
Corequisite: MA 611 or consent of instructor
Laplace transform with theory and application to problems in ordinary and partial differential equations arising from engineering and physics problems; Fourier integral and Fourier transforms and applications.

Mr. Cell

MA 633 OPERATIONAL MATHEMATICS II **3 (3-0) s**
Prerequisite: MA 632
Extended development of the Laplace and Fourier transforms and their uses in the solution of problems in ordinary and partial differential equations and in difference equations; Sturm-Liouville systems; advanced theory in ordinary and partial differential equations.

Mr. Cell

MA 635 MATHEMATICS OF COMPUTERS **3 (3-0) s**
Prerequisite: MA 512, 535
Corequisite: MA 622
The development of methods for the solution of selected problems involving matrices; integral rational equations; ordinary and partial differential equations. Particular attention is paid to the question of convergence and stability; examples solved on the IBM 650.

Mr. Caldwell

MA 641 CALCULUS OF VARIATIONS **3 (3-0) f**
Prerequisite: MA 512
The simplest problem of the calculus of variations in details; variable endpoints; iso-perimetric problems; Hamilton's principle; least action principle; introduction to the theory of linear integral equations of the volterra and Fredholm types.

Mr. Winton

MA 651 EXPANSION OF FUNCTIONS **3 (3-0) f**
Prerequisites: MA 611, 633 or consent of instructor
Expansion of functions of one or more variables in Taylor's series; asymptotic series, infinite products, partial fractions, continued fractions, series of orthogonal functions; applications in ordinary and partial differential equations, difference equations and integral equations.

Messrs. Cell, Harrington

MA 661 TENSOR ANALYSIS I **3 (3-0) f**
Prerequisites: MA 512, 541
Recommended (but not required) MA 521, 602, 622
The basic theory; tensor algebra, tensor calculus; invariant theory; quadratic differential forms; covariant differentiation, curvature tensor; geometric applications, Reimannian spaces, parallelism, geodesics, normal coordinates; generalized vector analysis; physical applications: dynamics, Lagrange's equations, generalized coordinates; the geometry of dynamics; kinematic and action line elements, holonomic and non-holonomic systems; configuration space, synamics in n-dimensions.

Mr. Levine

MA 662 TENSOR ANALYSIS II **3 (3-0) s**
Prerequisite: MA 661
Continuation of physical applications. Elasticity; finite strains, equations of compatibility, strain invariants, stress tensor, equations of motion, generalized Hooke's law, isotropic stress-strain relations; hydrodynamics; perfect fluids, viscous fluids, viscosity tensor; equations of motion, electro-magnetic theory; Maxwell's equations, plane waves, stress-energy tensor; relativity: Lorentz transformation, field equations, Schwarzschild solution, planetary orbits.

Mr. Levine

MA 681 SPECIAL TOPICS IN MATHEMATICS **3 (3-0) f s**
Prerequisites: Graduate standing and consent of instructor
Elective
This course provides an opportunity for small groups of graduate students to study, under the direction of qualified members of the professional staff, advanced topics in their special fields of interest.

Graduate Staff

MA 691 RESEARCH IN MATHEMATICS **Credits by arrangement**
Prerequisite: Graduate standing and approval of adviser
Individual research in the field of mathematics.

MATHEMATICS AND SCIENCE EDUCATION

ED 203 AN INTRODUCTION TO TEACHING **2 (2-0) s**
A course designed to aid prospective teachers in becoming familiar with the scope and purposes of secondary education, the qualification and responsibilities of teachers, the relation of the school to the community and current problems of secondary school teachers.

Mr. Speece

ED 470 METHODS OF TEACHING MATHEMATICS **3 (3-0) f**
A study of the purposes, methods, materials and evaluation practices appropriate for teachers of mathematics at the secondary level.

ED 471 STUDENT TEACHING IN MATHEMATICS **10 (2-20) f**
This course is intended to provide the prospective teacher with an opportunity to get experience in the skills and techniques involved in teaching mathematics. Each student during the senior year will spend one quarter off-campus in a selected center. In addition to acquiring the necessary competencies for teaching mathematics, the student teachers will also have an opportunity to become familiar with the total school program and to participate in as many community activities as time will permit during the period of student teaching.

ED 475 METHODS OF TEACHING SCIENCE **3 (3-0) f**
A study of the purposes, methods, materials and evaluation practices appropriate for teachers of physical and natural science at the secondary level.

ED 476 STUDENT TEACHING IN SCIENCE **10 (2-20) f**
This course is intended to provide the prospective teacher with an opportunity to get experience in the skills and techniques involved in teaching science. Each student during the senior year will spend one quarter off-campus in a selected center. In addition to acquiring the necessary competencies for teaching science, the student teacher will also have an opportunity to become familiar with the total school program and to participate in as many community activities as time will permit during the period of student teaching.

— — — — — — — — — — MECHANICAL ENGINEERING

COURSES FOR UNDERGRADUATES

ME 101, 102 ENGINEERING GRAPHICS I, II **2 (0-4) f s**
Corequisite: MA 101 or MA 111
The objective of these courses is to teach the student the proper methods and procedures for interpreting this medium of communication by the various theories and practices in the graphical field. Emphasis will be placed on instrument practice; geometrical construction; free hand technical sketching of all projects; completion of prepared worksheets; projections; sections; auxiliary projections; revolution; pictorial projections· fasteners, intersection and development; details and assemblies; charts and graphs; tracing and demonstrations in various reproductions; geometrical magnitudes represented by points, lines, planes and solids with emphasis upon visualization.

ME 271, 272 AIR CONDITIONING DRAWING I, II **2 (0-4) f s**
Prerequisite: ME 102
Required of sophomores in Heating and Air Conditioning
Drawing board work on heating symbols; sheet metal drawing, duct layout, steam piping (single line, double line, isometric and other pictorials); hot water and other piping, valves, traps, filters, and miscellaneous equipment; boiler hookups and connections; compressor and condenser layout; use of catalog data and tables as applied to drafting practices.

ME 301 ENGINEERING THERMODYNAMICS I **3 (3-0) f or s**
Prerequisites: MA 202, PY 201
Fundamental laws of energy transformations with emphasis on the First and Second Laws; behavior of gases and vapors; elementary applications.

ME 302 ENGINEERING THERMODYNAMICS II **3 (3-0) s**
Prerequisite: ME 301
A continuation of Engineering Thermodynamics I for Mechanical Engineering juniors. Thermodynamics of gaseous mixtures, combustion, gas compressors, steam turbines, refrigeration, air conditioning, internal combustion engines, and gas turbines.

ME 303 ENGINEERING THERMODYNAMICS III **3 (3-0) f**
Prerequisite: ME 301
A continuation of Engineering Thermodynamics I for non-Mechanical Engineering students. Applications of fundamental thermodynamic principles, particularly in the Heat Power field, elements of heat transfer.

ME 304 FUNDAMENTALS OF HEAT POWER **3 (3-0) f**
Prerequisite: PY 211
Energy and energy transformations, including a brief discussion of measurements of quantities involved. Properties of working substances, particularly steam. Elementary combustion of fuels. Steam power cycles and applications to steam turbines. Elements of Heat Transfer.

ME 305, 306 MECHANICAL ENGINEERING LABORATORY I, II **1 (0-3) f s**
Corequisite: ME 301, 302
Instrumentation as applied to pressure, temperature, speed, power, and fluid flow measurements; determination of properties of fuels and lubricants; applications of instrumentation to determination of characteristics of nozzles, pumps, turbines and compressors.

MECHANICAL ENGINEERING

ME 311 KINEMATICS **3 (1-6) f or s**
Prerequisites: ME 102, EM 311
Corequisite: EM 312
Required of juniors in ME and MEA.
This course is a study of kinematics of machines and consists of a systematic study of the displacements, velocities, and accelerations which occur in mechanisms.

ME 312 DYNAMIC ANALYSIS **3 (1-6) s**
Prerequisites: ME 311
Required of juniors in ME
The analysis and control of forces in machines. Includes inertia forces, free and forced vibrations, and control systems.

ME 351 ELEMENTS OF AERONAUTICAL ENGINEERING **3 (3-0) f**
Prerequisites: MA 202, PY 202
Corequisite: EM 312
The airplane and its component parts, terminology, basic fluid mechanics and the principles of flight, airfoil characteristics, and an introduction to performance and stability analysis.

ME 352 AERODYNAMICS **3 (3-0) s**
Prerequisite: ME 351, MA 401
Fundamental concepts underlying experimental aerodynamics, the aerodynamicist's data, elementary flow theory, Reynolds number and the effect of viscosity, Mach number and compressibility, finite wing theory.

ME 371, 372 ELEMENTS OF HEAT POWER I, II **3 (3-0) f s**
Prerequisites: MA 201, PY 212
Required of juniors in Heating and Air Conditioning
Basic laws of thermodynamics; applications to gaseous mixtures, combustion, compressors, refrigeration, heating and air conditioning; principles of steam power plants with emphasis on generation of steam and availability of by-product steam for heating purposes.

ME 375, 376 AIR CONDITIONING LABORATORY I, II **1 (0-3) f s**
Concurrent with ME 371, 372
Required of juniors in Heating and Air Conditioning
The use, limitation and calibration of instruments for the measurement of temperature, pressure, power, speed and fluid flow; measurement of properties of fuel and lubricants; determinations of characteristics of pumps, compressors and turbines.

ME 377 BUILDING MECHANICS A **3 (3-0) s**
For third year Architecture students only
Heating principles, systems and control; air conditioning principles, systems and controls; fuels, ventilation; pumps; and acoustical control.

ME 378 BUILDING MECHANICS B **3 (3-0) f**
For fourth year Architecture students only
Principles of plumbing including venting, drainage, demand and load calculations, water distribution, pipe sizing, storm drainage, sprinkler systems; elevators and conveyors; illumination, lighting and power circuits, panels and service connections and codes.

ME 379 MECHANICAL EQUIPMENT OF BUILDING **3 (3-0) s**
Prerequisite: ME 371
Required of seniors in Heating and Air Conditioning
Study of mechanical equipment of buildings including elevators, pumps, drainage and venting, pipe sizing of water lines, hot water storage and distribution, sprinkler systems, State and local codes for plumbing, heating, electrical and building trades; acoustical control, and the principles of wiring specifications for the mechanical trades.

ME 381, 382 AIR CONDITIONING I, II **3 (3-0) s f**
Prerequisite: ME 371
Required of seniors in Heating and Air Conditioning
Principles of heating and air conditioning and their applications to the design and operation of heating and air conditioning systems; methods of controls of various component parts of such systems.

ME 401 POWER PLANTS **3 (3-0) f or s**
Prerequisite: ME 302
Required of seniors in Mechanical Engineering
Application of thermodynamics, economics and principles studied in other basic courses of the mechanical engineering curriculum to the engineering of thermal power plants including the energy balance, combustion, steam generators, prime movers, heat transfer devices, compressors, pumps and auxiliaries.

ME 405, 406 MECHANICAL ENGINEERING LABORATORY III, IV **1 (0-3) f s**
Prerequisite: ME 306
Determinations of performance of heat power equipment with emphasis on heat transfer and fluid flow.

ME 410 JET PROPULSION **3 (3-0) s**
Prerequisite: ME 302 and ME 352 or EM 430
Application of fundamental principles of thermodynamics and the mechanics of a compressible fluid to the processes of jet-propulsion and turbo-propeller aircraft; the effect of performance of components on performance of engine; analysis of engine performance parameters.

ME 411, 412 MACHINE DESIGN I, II **3 (1-6) f s**
Prerequisites For ME 411: EM 321, for ME 412: ME 311, 411
Required of seniors in Mechanical Engineering
A study of the methods of designing machine elements to withstand steady and varying forces and to operate without excessive wear at friction areas. Elementary stress analysis is followed by combined stresses, applied to such elements as keys, shafts, springs, bearings, belting, clutches, brakes, frames, and gears.

ME 441 TECHNICAL SEMINAR **1 (1-0) f or s**
Prerequisite: Graduating Senior standing
Meetings once a week for the delivery and discussion of student papers on topics of current interest in Mechanical Engineering.

ME 453 APPLIED AERODYNAMICS **3 (3-0) f**
Prerequisite: ME 351
Determination of design data, turnnel wall and ground effect interference corrections, spanwise and chordwise load distributions, performance estimation, and stability and control analysis. Attention is given to transonic and supersonic aerodynamics.

ME 455, 456 AERONAUTICAL LABORATORY I, II **1 (0-3) f s**
Prerequisites: ME 351
Demonstration of wind tunnel testing methods and principles of fluid motion. Aerodynamic tests of airplane components and complete models. Calibration of instruments and other laboratory exercises related to aeronautical engineering.

ME 459 AIRCRAFT STRUCTURES **3 (3-0) f**
Prerequisites: ME 351, EM 321
Theory of aircraft structures, design principles and methods of stress analysis, emphasis on thin-walled structures.

ME 461, 462 AIRPLANE DESIGN I, II **3 (1-6) f s**
Prerequisites: For ME 461, ME 351; for ME 462; ME 461, 459
Design procedure, preliminary layout from design specifications, weight and balance performance estimation, control and stability analysis, principles of stress analysis.

ME 473 REFRIGERATION **3 (3-0) f**
Prerequisite: ME 372
Required of seniors in Heating and Air Conditioning
The fundamental principles of refrigeration, the performance of various types of refrigerating machines and their applications to air conditioning; controls of such systems.

ME 475, 476 AIR CONDITIONING LABORATORY III, IV **1 (0-3) f s**
Concurrent with ME 481, 482
Required of seniors in Heating and Air Conditioning
The testing of heat transfer equipment including feed water heaters, radiators, convectors, unit heaters, heating panels; heating boilers, hot air furnaces, stokers, oil burners; air conditioners of both the spray and coil types evaporative condensers.

ME 481, 482 AIR CONDITIONING DESIGN I, II **3 (1-6) f s**
Prerequisite: ME 381
Required of seniors in Heating and Air Conditioning
The design, layout and cost estimates of various types of heating and air conditioning systems.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ME 501 STEAM AND GAS TURBINES **3 (3-0) f**
Prerequisites: ME 302 and EM 430 or ME 352
Fundamental analysis of the theory and design of turbomachinery flow passages: control and performance of turbomachinery; gas-turbine engine processes.

MECHANICAL ENGINEERING

ME 502 HEAT TRANSFER **3 (3-0) f or s**
Prerequisite: ME 301
A study of the fundamental laws of heat transfer by conducting convection and radiation; steady and unsteady states heat transfer; elementary application to heat transfer equipment.

ME 507, 508 INTERNAL COMBUSTION ENGINE FUNDAMENTALS **3 (3-0) f s**
Prerequisite: ME 302
The fundamentals common to internal combustion engine cycles of operation. The Otto engine: carburetion, fuel distribution, flame propagation, normal and knocking combustion, throttling, pumping, valve and spark timing, and altitude effects; the Diesel engine: injection and spray formation fuel rating, atomization, penetration, diesel knock, combustion, pre-combustion, and scavenging as applied to reciprocating and rotary engines.

ME 515 EXPERIMENTAL STRESS ANALYSIS **3 (2-3) f**
Prerequisites: ME 312, EM 321
Stresses determined experimentally by photoelasticity methods, by mechanical and electrical strain gages, by brittle coatings, etc. Effects of varying stresses.

ME 517 LUBRICATION **3 (2-3) s**
Prerequisite: EM 430
The theory of viscous and boundary lubrication. Bearing design from various approaches. Thermal equilibrium. Properties of lubricants.

ME 536 AIRCRAFT ENGINES **3 (3-0) s**
Prerequisite: ME 302
Spark-ignition, compression-ignition, and jet engines are studied from the standpoint of design, construction, and operation and as they apply to aircraft.

ME 545, 546 PROJECT WORK IN MECHANICAL ENGINEERING I, II **2 (0-6) f s**
Individual or group assigned design, construction, analytical or experimental projects in Mechanical Engineering.

ME 551 FLYING QUALITIES **3 (3-0) f**
Prerequisite: ME 352
Evaluation of flying qualities of airplanes, important factors and criteria for design, analysis of stick-fixed and stick-free control and stability, maneuvering stability, lateral controllability, and stick force determination.

ME 552 AIRCRAFT APPLIED LOADS **3 (3-0) s**
Prerequisite: ME 453
Determination of aerodynamics loads, maneuvering and gust loads, V-g diagram, spanwise distributions on unswept and swept wings, dynamic flight loads. Consideration of the load modifications in the transonic flight range.

ME 553 PROPELLER AND ROTARY WING DESIGN **3 (3-0) f**
Prerequisite: ME 352
A study of the design of aircraft propellers and rotary wing theory and design. Discussion of problems of performance evaluation, control and stability, as applied to rotating wing aircraft.

ME 554 ADVANCED AERODYNAMIC THEORY **3 (3-0) s**
Prerequisite: ME 352
Development of fundamental aerodynamic theory. Emphasis upon mathematical analysis and derivation of equations of motion, airfoil theory and comparison with experimental results. Introduction to supersonic flow theory.

ME 562 ADVANCED AIRCRAFT STRUCTURES **3 (3-0) s**
Prerequisite: ME 459
Development of methods of stress analysis for aircraft structures, special problems in structural design, stiffened panels, rigid frames, indeterminate structures, general relaxation theory.

ME 571 AIR CONDITIONING **3 (3-0) f**
Prerequisite: ME 302
Principles of heating and ventilation; warm air, steam and hot-water heating systems; air conditioning.

ME 572 REFRIGERATION **3 (3-0) s**
Prerequisite: ME 302
An analysis of the simple, compound, centrifugal and multiple effect compression system, the steam jet and the absorption systems of refrigeration.

COURSES FOR GRADUATES ONLY

ME 601, 602 ADVANCED ENGINEERING THERMODYNAMICS I, II **3 (3-0) f s**
Prerequisite: ME 302 or ME 303
First and Second Laws; theory of variable specific heats; general equations of thermodynamics; characteristic equations of state; reduced coordinates; prediction of properties of gases and vapors; chemical equilibrium; metastable states; thermodynamics of fluid flow.

ME 603 ADVANCED POWER PLANTS **3 (3-0) f**
Prerequisite: ME 401
A critical analysis of the energy balance of thermal power plants thermodynamics and economic evaluation of alternate schemes of development; study of recent developments in the production of power.

ME 604 NUCLEAR POWER PLANTS **3 (3-0) s**
Prerequisites:ME 302, 502, EM 430, PY 419
Resources of fuels, power reactors, reactor materials and properties, coolants, pumps, heat exchangers, nuclear gas turbine power plants, nuclear steam power plants special purpose plants, the economics of nuclear power and selected topics on shielding waste disposal and health precautions.

ME 611, 612 ADVANCED DESIGN I, II **3 (3-0) f s**
Prerequisite: ME 412
Stress analysis applied to advanced design problems; unsymmetric bending, curved beams, flat plates, non-circular members in torsion, thick walled cylinders, localized stresses; special problems according to the interests of the class.

ME 613 MECHANICS OF MACHINERY **3 (3-0) f**
Prerequisite: ME 311
Kinetics of machines, with emphasis on inertia forces; balancing of machine members and reciprocating machines.

ME 641, 642 MECHANICAL ENGINEERING SEMINAR I, II **1 (1-0) f s**
Faculty and graduate student discussions centered around current research problems and advanced engineering theories and developments.

ME 645 MECHANICAL ENGINEERING RESEARCH **3 to 6**
Prerequisite: Graduate standing in ME and approval of adviser.
Individual research in the field of Mechanical Engineering.

ME 651 PRINCIPLES OF FLUID MOTION **3 (3-0) f**
Prerequisite: ME 352 or equivalent
Co-requisite: MA 511
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.

ME 652 DYNAMICS OF COMPRESSIBLE FLOW **3 (3-0) s**
Prerequisite: ME 651
Properties of compressible fluids, equation of motion of one-dimensional motion, channel flows, stock wave theory, methods of observation, and flows at transonic speeds.

ME 653 SUPERSONIC AEODYNAMICS **3 (3-0) f**
Prerequisite: ME 652
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.

ME 654 DYNAMICS OF VISCOUS FLUIDS **3 (3-0) s**
Prerequisite: ME 651
Development of the Navier-Stokes equations and the boundary layer theory. Laminar and turbulent boundary layers in theory and experiment, flow separation, and transition.

ME 671, 672 ADVANCED AIR CONDITIONING DESIGN I, II **3 (3-0) f s**
Prerequisites: ME 571, 572
The design of heating and air conditioning systems; the preparation of specifications and performance tests on heating and air conditioning equipment.

METALLURGICAL ENGINEERING

COURSES FOR UNDERGRADUATES

MIM 201, 202 STRUCTURE AND PROPERTIES OF ENGINEERING MATERIALS I, II **3 (2-3) f s**

Prerequisite: CH 103
I An introduction to the fundamental physical principles governing the structure and constitution of metallic and non-metallic materials of construction, and the relation of these principles to the control of properties.
II Important applications of engineering materials and criteria for selection of materials.

MIM 321 METALLURGY **3 (2-3) s**

Prerequisite: CH 103
A general course in physical metallurgy including laboratory work.
The constitution, structure, and properties of metals and alloys.

MIM 331, 332 PHYSICAL METALLURGY I, II **3 (3-0) f s**

Prerequisites: CH 103, MIM 201
Required of juniors in MTE
The fundamental principles of physical metallurgy with emphasis on correlation between structure, constitution, and properties of metals and alloys. A systematic development of the metallurgical aspects of atomic and crystalline structure, solid solutions, diffusion, precipitation hardening, elastic and plastic behavior, and recrystallization.

MIM 401, 402 METALLURGICAL OPERATIONS I, II **4 (3-3) f s**

Prerequisite: MIM 332
A systematized treatment of the fundamental operations involved in the production and fabrication of metals and alloys. Part I deals primarily with procedures and operations employed in chemical or extractive metallurgy. Part II covers the operations of physical and mechanical metallurgy.

MIM 421, 422 METALLURGY I, II **2 (2-0) f s**

Prerequisite: CH 103
Required of seniors in ME and MEA
The constitution, structure and properties of engineering ferrous and non-ferrous metals and alloys; influences of mechanical working and heat treatment; physical testing, corrosion and its prevention. Laboratory work included in second semester.

MIM 423 METALLURGICAL LABORATORY **1 (0-3) f s**

Co-requisite: MIM 421 or 422
Laboratory work to accompany Metallurgy I, II

MIM 431, 432 METALLOGRAPHY I, II **3 (2-3) f s**

Prerequisite: MIM 332
An intensive study of the principles and techniques for examination and correlation of the structure, constitution, and properties of metals and alloys.

MIM 445, 446 EXPERIMENTAL ENGINEERING I, II **3 (1-6) f s**

Prerequisite: MIM 422 or approval of instructor
Advanced engineering principles applied to a specific project dealing with metallurgy, metallography, or general experimental work. A seminar period provided and a written report required.

MIM 451, 452 METALLURGICAL ENGINEERING SEMINAR **1 (1-0) f s**

Prerequisite: Senior Standing in MTE
Reports and discussion of special topics in metallurgical engineering and related subjects.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MIM 521, 522 ADVANCED PHYSICAL METTALLURGY I, II **3 (3-0) f s**

Prerequisite: MIM 422 or 432
Theories concerning behavior and control of engineering alloys, reaction rates in the solid state and alloy influences; current heat treating practices, surface treatments; behavior of metals at high and low temperatures; special purpose alloys; powder metallurgy; review of modern equipment and methods for the study of metals.

MIM 523, 524 METALLURGICAL FACTORS IN DESIGN **2 (2-0) f s**

Prerequisite: MIM 422
A study of the metallurgical factors that must be considered in using metals in design.

MIM 541, 542 PRINCIPLES OF CORROSION I, II **3 (2-3) f s**

Prerequisite: MIM 422
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.

MIM 561 ADVANCED STRUCTURE AND PROPERTIES OF MATERIALS **3 (2-3) f**
Prerequisite: MIM 422
A systematic treatment of the fundamental physico-chemical principles governing the constitution of both metallic and ceramic materials. Correlation of these principles with physical mechanical and chemical properties of materials. Particular emphasis is placed upon materials of construction for nuclear reactors. Lecture and Laboratory.

MIM 562 MATERIALS PROBLEMS IN NUCLEAR ENGINEERING **3 (2-3) s**
Prerequisite: MIM 561
Engineering aspects of problems involved in the selection and application of reactor materials. Specific attention is given to elevated temperature behavior, fatigue, corrosion, irradiation damage, and the fabrication and processing of these materials. Lecture and Laboratory.

COURSES FOR GRADUATES ONLY

MIM 651, 652 THEORY AND STRUCTURE OF METALS **3 (3-0) f s**
Prerequisite: MIM 522
An advanced interpretation of the development of theories of the metallic state with emphasis on modern physical concepts. Topics include theory of crystallinity, bonding forces, stability of metallic structures, diffusion, and dislocation theory.

MIM 695 METALLURGICAL ENGINEERING RESEARCH **Credits by arrangement**
Independent investigation of an appropriate problem in Metallurgical Engineering. A report on this investigation is required as a graduate thesis.

MILITARY SCIENCE AND TACTICS

MILITARY SCIENCE—THE BASIC COURSE*

MS 101, 102 MILITARY SCIENCE I **2 (2-2) f s**
Classroom instruction is given in Military History, Organization of the Army, Individual Weapons and Marksmanship, and Military Courtesy. On the drill field, emphasis is placed on development of teamwork, esprit de corps, and essential characteristics of leadership.

MS 201, 202 MILITARY SCIENCE II **2 (0-4) f s**
Prerequisites: Military Science I or equivalent credit
Classroom instruction is given in Map Reading, Crew-served Weapons, Gunnery and Role of the Army in National Defense. On the drill field, emphasis is placed on development of teamwork, esprit de corps, essential characteristics of leadership, and acceptance of responsibility.

THE ADVANCED COURSE

MS 301, 302 MILITARY SCIENCE III **3 (2-4) f s**
Prerequisites: Military Science I and II, or equivalent credit
Classroom instruction is given in Tactics, Organization, Function and Mission of the Arms and Services, Methods of Instruction, Communications, and Leadership. On the drill field, further emphasis is placed on acceptance of responsibility, exercise of command, and development of self-confidence, initiative and dignity in appearance and demeanor.

MS 401, 402 MILITARY SCIENCE IV **3 (2-4) f s**
Prerequisites: Military Science III and satisfactory completion of six weeks' summer camp training.
Classroom instruction is given in Tactics, Logistics, Operations, Personnel Management, Military Administration, and Service Orientation. On the drill field, emphasis is placed on exercise of command, planning and executing all phases of training (instruction in basic fundamentals, inspections, ceremonies, and competitions) and maximum development of teamwork, esprit de corps, and leadership characteristics.

AIR SCIENCE—THE BASIC COURSE*

AS 121, 122 AIR SCIENCE I **2 (2-2) f s**
Foundations of Air Power. A general survey of air power designed to provide the student with an understanding of the elements of air power and basic aeronautical science.

AS 221, 222 AIR SCIENCE II
Prerequisite: AS I or equivalent credit
Instruction is given in Elements of Aerial Warfare, Careers in USAF, and Leadership Laboratory—Cadet Non-Commissioned Officers' Training.

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* All veterans in service as long as six months are excused from this course but may enroll in the basic course in Army or Air Force ROTC to qualify for later enrollment in advanced courses. See also the Division of Military and Air Science and Tactics, pages 163-166.

MODERN LANGUAGES

THE ADVANCED COURSE

AS 321, 322 AIR SCIENCE III **3 (4-2) f s**
Prerequisites: AS I and II or equivalent credit
Instruction is given in Air Force Commander and Staff, Problem Solving Techniques, Communications Process and Air Force Correspondence, Military Justice System, Applied Air Science, Aircraft Engineering, Navigation and Weather, Air Force Base Functions, and Leadership Laboratory.
Note: Cadets attend Summer Camp after Air Science III and before taking Air Science IV.

AS 421, 422 AIR SCIENCE IV **3 (4-2) f s**
Prerequisite: AS III
Summer Camp is critiqued. Instruction is given in Principles of Leadership and Management (Seminar), Career Guidance, Military Aspects of World Political Geography, Military Aviation and the Art of War, Briefing for Commissioned Service, and Leadership Laboratory.

MINERAL INDUSTRIES

CERAMIC ENGINEERING (see pages 182-184)

GEOLOGY (see pages 221-223)

METALLURGICAL ENGINEERING (see pages 250-251)

MODERN LANGUAGES

Courses numbered above ML 106 need not be followed as a sequence in their respective gamut.

Two years of high school language will normally be considered the equivalent of one year of college instruction in that language. All students registering for a language course will be **examined** on proficiency and scheduled for the course for which they are fitted.

FRENCH

ML 101 ELEMENTARY FRENCH **3 (3-0) f s**
Structure, diction, pronunciation and other matters of technique of the language, supplemented by readings and translations. No previous training in the language necessary.

ML 102 FRENCH GRAMMAR AND PROSE READING **3 (3-0) f s**
Prerequisite: ML 101 or equivalent
A survey of the basic elements of grammar accompanied and illustrated by intermediate readings progressing to the reading of standard texts.

ML 201 FRENCH PROSE: SELECTIONS FROM MODERN FRENCH LITERATURE **3 (3-0) f s**
Prerequisites: ML 101, 102 or equivalent
Selected readings from literary French of the 18th and 19th centuries. Attention given to the attainment of skill in reading and comprehension.

ML 202 FRENCH PROSE: FRENCH CIVILIZATION **3 (3-0) f s**
Prerequisites: ML 101, 102 or equivalent
After a preliminary survey of the land and people of France, such topics as language, arts, science, literature, philosophy, etc., are given consideration. Parallel readings and reports.

ML 301 SURVEY OF FRENCH LITERATURE **3 (3-0) f s**
Prerequisite: Junior or senior standing
Lectures illustrated by selected readings in translation covering the development of the novel, the drama, the short story and the poetry of France from the 12th century to the present. Parallel readings and reports. No language prerequisites.

ML 401, 402 INTRODUCTORY SCIENTIFIC FRENCH **3 (3-0) f s**
Prerequisites: ML 201, 202 or equivalent
A study of scientific French of intermediate difficulty, supplemented with lectures on terminology and other linguistic techniques. The needs of students whose interest is that of the acquisition of a reading knowledge of the language are constantly kept in view. Basic technique of translation explained and demonstrated by means of personal conferences.

ML 501 502 ADVANCED SCIENTIFIC FRENCH **3 (3-0) f s**
Prerequisite: Knowledge of basic French grammar.
A study of scientific literature appearing in current bulletins, magazines and technical journals. Designed to meet the needs of students whose interest in the language is primarily that of reading ability. Choice of reading material adjusted to individual needs: may be taken by students of varying degrees of previous linguistic training.

GERMAN

ML 103 ELEMENTARY GERMAN **3 (3-0) f s**
Study of the structure and technique of the language, supplemented by easy reading and translations. No previous training in the language necessary.

ML 104 GERMAN GRAMMAR AND PROSE READING **3 (3-0) f s**
Prerequisite: ML 103 or equivalent
A course designed primarily for students who wish to attain proficiency in reading German. Attention given to basic grammar and vocabulary with practice in the translation and interpretation of German prose.

ML 203 GERMAN PROSE: SELECTIONS FROM MODERN GERMAN LITERATURE **3 (3-0) f s**
Prerequisites: ML 103, 104 or equivalent
Readings in German Literature, a study of representative authors and their contribution to the development of the German language and culture. Parallel readings and reports.

ML 204 GERMAN PROSE: GERMAN CIVILIZATION **3 (3-0) f s**
Prerequisites: ML 103, 104 or equivalent
Readings in the history and customs of Germany, supplemented by lectures on such topics as language, arts, science, philosophy, etc. Parallel readings and reports.

ML 303 SURVEY OF GERMAN LITERATURE **3 (3-0) f s**
Prerequisite: Junior or senior standing
The study of various types of German Literature. A brief outline of German literary development. Parallel readings in translation. No previous training in the language necessary.

ML 403, 404 INTRODUCTORY SCIENTIFIC GERMAN **3 (3-0) f s**
Prerequisites: ML 203, 204 or equivalent
A study of scientific German of intermediate difficulty supplemented with lectures on terminology and other linguistic techniques. The needs of students whose interest is that of the acquisition of a reading knowledge of the language are constantly kept in view. Basic technique of translation explained and demonstrated by means of personal conferences.

ML 503 GERMAN GRAMMAR FOR GRADUATE STUDENTS **3 (3-0) f s**
This course is open to Graduate Students only and is designed to present the grammar of scientific German as rapidly as possible in preparation for the reading course which follows.

ML 504 SCIENTIFIC GERMAN **3 (3-0) f s**
Prerequisite: ML 503 or equivalent
Reading and translation of technical German, supplemented by discussions on terminology, word order, vocabulary analysis and other linguistic techniques. Subject material adjusted to individual needs; conferences.

SPANISH

ML 105 ELEMENTARY SPANISH **3 (3-0) f s**
Structure, diction, pronunciation and other matters of technique of the language, supplemented by easy readings. No previous training in the language necessary.

ML 106 SPANISH GRAMMAR AND PROSE READING **3 (3-0) f s**
Prerequisite: ML 105 or equivalent
A survey of the basic elements of grammar accompanied and illustrated by intermediate readings progressing to the reading of standard texts.

ML 205 SPANISH PROSE: IBERIA **3 (3-0) f s**
Prerequisites: ML 105, 106 or equivalent
Emphasis is placed upon translating Spanish prose and developing vocabulary. The readings give the student a comprehensive picture of the culture, geography, history and economy of Spain.

ML 206 SPANISH PROSE: HISPANO-AMERICA **3 (3-0) f s**
Prerequisites: ML 105, 106 or equivalent
Emphasis is placed upon translating Spanish prose and developing vocabulary. The readings give the student a comprehensive picture of the culture, geography, history and economy of the Spanish American countries.

ML 305 SURVEY OF SPANISH LITERATURE **3 (3-0) f s**
Prerequisite: Junior or senior standing
Lecture illustrated by selected reading in translation covering the development of the novel, drama, short story and poetry of Spain from 1300 to the present. Parallel reading and reports by students.

ML 307, 308 TECHNICAL SPANISH **3 (3-0) f s**
Prerequisite: ML 205 or equivalent
A study of technical and industrial literature. Particular attention given to the special terminology characteristic of such literature with a view to the acquisition of a practical vocabulary. Individual conferences and reports.

ML 405, 406 SCIENTIFIC SPANISH **3 (3-0) f s**
Prerequisites: ML 307, 308 or equivalent
A study of scientific literature appearing in current bulletins, magazines and technical journals. Students given the opportunity of working a translation project in connection with their subject of major interest. Special attention given to the comprehension of the thought of the article under consideration and to its accurate rendition into English. Parallel readings, reports and conferences.

ENGLISH (FOREIGN STUDENTS)

ML 107 ELEMENTARY ENGLISH: PRONUNCIATION **3 (3-0) f s**
Emphasis in this course is laid upon the pronunciation and comprehension of American English. Through oral reports students are encouraged to improve their diction and pronunciation. Comprehension is approached through dictation and lectures. Attention to grammar and spelling is given as individual problem arise.

ML 108 ELEMENTARY ENGLISH: READING **3 (3-0) f s**
Emphasis in this course is laid upon the rapid comprehension of written English without the necessity of the student's first translating the material into his own language. Exercises are given in paraphrasing the material read. Continued practice on pronunciation, spelling and grammar. Special attention is paid to idiomatic expressions and Americanisms.

ML 109 ELEMENTARY ENGLISH: COMPOSITION **3 (3-0) f s**
Emphasis in this course is laid upon the writing of English, special attention being given to compositions, grammatical exercises, sentence structure, spelling and diction.

RUSSIAN

ML 110 ELEMENTARY RUSSIAN **3 (3-0) f s**
Structure and technique of the language, supplemented by easy readings and translations. Individual reports and conferences.

ITALIAN

ML 112 ELEMENTARY ITALIAN **3 (3-0) f s**
Structure, diction, pronunciation and other matters of technique of the language, supplemented by easy readings, individual reports and conferences. No previous training in the language required.

ML 113 ITALIAN GRAMMAR AND PROSE READING **3 (3-0) f s**
Prerequisite: ML 112 or equivalent
A survey of basic elements of grammar accompanied and illustrated by intermediate readings, progressing to the reading of standard texts.

GENERAL COURSES

ML 321, 322 ROMANCE LITERATURE **2 (2-0) s**
Prerequisite:Junior or senior standing
A course cutting across language barriers to illustrate the most outstanding literary productions of France, Spain, Italy and Portugal and showing the cultural and social pattern of these nationalities having a common language inheritance. Selected readings and reports.

ML 323, 324 GERMANIC LITERATURE **2 (2-0) s**
Prerequisite: Junior or senior standing
A study of the literary productions in each of the various types of Germanic literature, and lectures on their cultural background. Designed primarily to meet the needs of students who wish to supplement their knowledge of their own literature with that of the literature of other civilizations. Attention is given to the literary monuments of Germany, Holland, Denmark, Iceland and the Scandinavian countries. No foreign language prerequisites.

— — — OCCUPATIONAL INFORMATION AND GUIDANCE

ED 420 PRINCIPLES OF GUIDANCE **2 (2-0) f s**
This is a course designed to provide basic principles of guidance for teachers, teacher-counselors, administrators and others in the school, as well as workers in other areas such as the community agency, business, industry, group work and the like. Among the topics covered are: need for guidance; bases of guidance services; programs of guidance; studying the individual; counseling for educational, vocational, social, and personal problems; group procedures in guidance. Emphasis is on the practical application of guidance principles and procedures.

Mr. Morehead

ED 424 OCCUPATIONAL STUDIES **2 (2-0)**
Designed for majors in Industrial Arts and Vocational Education and emphasizing Industrial occupations. Uses of educational and occupational information, sources, preparation and interpretation of occupational materials. Occupational and industrial structure, local and national trends, occupations in selected industries. Labor legislation. Job adjustment and satisfaction. Providing occupational information to individuals and groups.

Mr. Morehead

ED 524 OCCUPATIONAL INFORMATION **3 (3-0) s**
This course is designed to prepare teachers, counselors, business and industrial personnel workers, placement workers and others to collect, evaluate and use occupational and educational information. In addition to the study of the usual source and types of published occupational information attention will be given to collection of occupational information locally, preparation of the occupational monograph, analysis of job requirements and worker characteristics, occupational trends and factors affecting trends, occupational and industrial structure and classification and the like. Imparting occupational information to groups and individuals by techniques such as the following are considered: the occupations unit in social studies and other courses, the occupations course, homeroom activities, introducing occupational information informally in subject matter courses, the resource file, vocational counseling.

Mr. Morehead

ED 530 GROUP GUIDANCE **3 (3-0) f**
This course is designed to help teachers, counselors, administrators and others who work with groups or who are responsible for group guidance activities to understand the theory and principles of effective group work, to develop skill in using specific group guidance techniques and to plan and organize group activities in the secondary school and other institutions. The relationship of group activities to counseling and other aspects of guidance services is considered. Methods of evaluating and improving group guidance activities are taken up.

Mr. Morehead

ED 531 INTRODUCTION TO VOCATIONAL REHABILITATION, PROGRAMS AND PROCESSES **3 (3-1) f**
This course will serve as an introduction to the broad field of rehabilitation services and programs directed toward the restoration of physically and/or mentally disabled persons into employment. The course will emphasize the State-Federal, and private agency programs. It will be inter-disciplinary in its approach covering the areas of social work, medicine, psychology, sociology and economics. Specialists or appropriate persons in the above areas will be invited to participate. Field trips to agencies will be required.

Mr. Anderson

ED 532 MEDICAL INFORMATION FOR REHABILITATION COUNSELORS **3 (3-0) f**
Prerequisites: ED 531 or equivalent and consent of instructor
This course is designed for Vocational Rehabilitation Counselors and other workers in rehabilitation. The course will provide counselors with the necessary background in medical information and terminology so that they can understand and interpret medical information in the integrated rehabilitation process. The course will consist of lectures by medical specialists who will present the methods of diagnosis, treatment and the rehabilitation aspects of disabling conditions. Visits will be made to clinics.

Mr. Anderson

PHILOSOPHY AND RELIGION

ED 590 INDIVIDUAL PROBLEMS IN GUIDANCE **3 (3-0) 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 and reports will be developed by individuals and by groups.

Messrs. Anderson, Morehead

COURSES FOR GRADUATES ONLY

ED 631 EDUCATIONAL AND VOCATIONAL GUIDANCE **3 (3-0) f**
This course aims to provide training for teachers who are part-time or full-time counselors, employment interviewers, social workers and personnel workers, who are aiding individuals with vocational adjustment problems. The course will cover the functions performed in vocational and educational guidance such as assembling and imparting occupational information, counseling regarding vocational and educational plans, the use of aptitude tests, placement in jobs and follow-up and procedures in setting up services of vocational and educational guidance in schools, employment offices and social service agencies.

Mr. Anderson

ED 633 TECHNIQUES IN GUIDANCE AND PERSONNEL **3 (3-0) s**
This course is designed to aid personnel workers in secondary schools, colleges, employment offices and social agencies to develop an understanding of and skill in using various guidance and personnel techniques. Some of the techniques to be studied intensively are: anecdotal reports, rating scales, observation, records and reports, sociograms, interviewing, counseling and case study procedures. Students will become acquainted with these techniques through lectures, demonstrations and the study of case histories. Attention will be given to both diagnosis and treatment.

Mr. Anderson

ED 641 FIELD WORK IN OCCUPATIONAL INFORMATION **2 to 12 f s**
A practical course in which the student undertakes field work in secondary schools, colleges, social service agencies, employment offices and industrial establishments which carry on guidance and personnel work. The students may observe and participate in some personnel services and may study the organization and administration of the programs.

Messrs. Anderson, Morehead

ED 651 RESEARCH IN OCCUPATIONAL INFORMATION AND GUIDANCE **Maximum 6 credits f s**
Qualified students will conduct investigations and research in Guidance and Personnel. Published reports and techniques in investigation will be analyzed and evaluated.

Messrs. Anderson, Morehead

PHILOSOPHY AND RELIGION — — — — — — — — —

COURSES FOR UNDERGRADUATES

PHI 201 LOGIC **3 (3-0) f s**
Language as symbol system, the formal structure of reasoning, and characteristics of empirical knowledge; emphasis on the establishment of more adequate reflective habits.

PHI 203 EFFECTIVE LIVING **2 (2-0) f s**
The meaning of personal growth and maturity; the quest for intellectual and emotional equilibrium in the face of the challenge which modern conditions pose for traditional patterns of thought and behavior; formulation of personal philosophy of life.

PHI 205 PROBLEMS AND TYPES OF PHILOSOPHY **3 (3-0) f s**
The great philosophers of the western world, the socio-cultural heritage in which they worked, their major concerns and conclusions; the relation of philosophy to vital questions of human life.

REL 301 RELIGIOUS GROUPS AND TRENDS IN THE UNITED STATES **2 (2-0) f s**
Background and characteristic beliefs of the major religious groups in the United States; survey of the dominant trends and movements in contemporary American religion.

REL 302 THE BIBLE AND ITS BACKGROUND **3 (3-0) f s**
Background of the Bible: origin, growth and development of central concepts, leading personalities, and the process by which it has come to us as viewed in the light of modern scholarship.

REL 303 CHRISTIAN ETHICS **2 (2-0) f s**
An analysis of the major areas of modern life in the light of the ethical teachings of Christianity, with an examination of the religious faith upon which these teachings rest.

PHI 305 PHILOSOPHY OF RELIGION **3 (3-0) f s**
Psychological and historical roots of religious belief; science and religion; the rational foundations of theism; the concept of God in Western thought.

PHI 306 PHILOSOPHY OF ART **3 (3-0) f s**
Theory of beauty and aesthetic experience, analysis of specific media of artistic expression and the formulation of a philosophy of art which relates the beautiful and the useful.

PHI 309 MARRIAGE AND FAMILY LIVING **3 (3-0) f s**
Secular and religious concepts of marriage; economic, physiological and socio-psychological aspects of premarital and marital relationships; parenthood; analysis of principles in terms of which value judgments relative to marriage and family living may be made with maximum rationality; formulation of a philosophy of marriage.

PHI 311 PARENT-CHILD RELATIONSHIPS **2 (2-0) f s**
Principles of inter-personal relationships; the enhancement of democratic values and the attainment of growth on the part of parent and child through the exercise of freedom, responsibility and creative activity; consideration of conflicting theories of husband-wife, and parent-child relationships.

PHI 395 PHILOSOPHICAL ANALYSIS **3 (3-0) f s**
Semantical, logical and experimental methods of investigation; intensive application of critical inquiry to a few fundamental problems including the nature of knowledge and its validation, and value judgment; major objective to afford the student personal participation in and acquaintance with philosophical analysis as intellectual tool with wide applicability.

PHI 401 FOUNDATIONS OF SCIENCE **3 (3-0) f s**
Nature and validity of knowledge, basic concepts of modern science, scientific method and the implications of the philosophy of modern science for ethics, social philosophy and the nature of reality.

REL 403 RELIGIONS OF THE WORLD **3 (3-0) f s**
Background, general characteristics and basic teachings of the major living religions of the world; consideration of contemporary secular movements that are in a sense religions.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PHI 501 SOCIAL ETHICS **3 (3-0) f s**
Prerequisite: Six term credits in Philosophy or related fields
Major ethical theories and the issue posed as basic in each; the problem of value in the light of modern knowledge; ethical principles as ground for cultural unity; the applicability of ethics to problems of policy determination.

REL 502 PROBLEMS OF RELIGION **3 (3-0) f s**
Prerequisite: Six term credits in Religion or related fields
Major trends in contemporary theology; the significance of the resurgent interest in religion and the remarkable growth of the churches in recent times; problems of effective communication at the theological level; the ecumenical movement.

PHYSICAL EDUCATION

The college requires all freshmen and sophomores to take physical education unless they are excused by the Health Service Physician for physical reasons. As explained in the paragraph below, veterans are given special considerations. Normally, credit in four physical education courses is required for graduation. All physical students must pass a swimming test.
Activities in the physical education program are divided into two program areas: Prescribed Sports and Controlled Elective Sports. Insofar as facilities and staff permit, every effort is made to direct students into activities which will meet their individual needs. The bases for determining individual needs are as follows:

A medical examination. In case a student has some unusual physical impairment, the college physician will either excuse him from physical education or recommend a special type of activity suitable to the particular need.
A swimming test. All freshmen and transfer students who fail to pass the swimming test are immediately assigned to beginning swimming. Students who pass the test are classified primarily on the basis of their scores in the athletic ability test.
An athletic ability test. Students who score below the 15th percentile are enrolled in Fundamental Sports for two semesters, or until their improvement indicates that they are ready for Basic Sports.
Students who score between the 15th and 75th percentiles are placed in Basic Sports for two semesters, or until their improvement indicates that they are ready for the Controlled Elective Sports Area.
Students who score above the 75th percentile are immediately directed to the Controlled Elective Sports Area.
Normally, all second year students participate in the Controlled Elective Sports Area. This part of the program is controlled to the extent that a student may not receive credit in more than two team sports.

PHYSICAL EDUCATION

REQUIREMENT FOR VETERANS:

1—All servicemen who have taken as much as six-months military service will receive one year of credit. PE 101, PE 102.
2—All servicemen will be required to take one year of Physical Education. (PE 201, PE 202.)
3—A former student or transfer student with one earned semester credit in physical education plus military service must earn one more semester credit (PE 202).
4—A student who has earned one year (2 semester credits) here or elsewhere, plus his credit of one year for military service will have completed his requirements.
5—Servicemen who have received credit for two full years of physical education may elect to take additional courses which would be in the 300 series. PE 301, PE 302, PE 303, PE 304.
6—All students who have received one year of credit in physical education, from military service or as a transfer student, will be exempt from the hygiene requirement.
7—All students who take even one semester of physical education as a required course at North Carolina State College must pass the swimming requirement.

Hygiene: All freshmen must complete satisfactorily a half semester of hygiene or show adequate proficiency as measured by a Health Knowledge Test given during Orientation Week. Students who are exempted from Hygiene must substitute a sports activity.

COURSES

PE 101, 102 **1 (0-2) f s**

PE 201, 202 **1 (0-2) f s**

PE 301, 302, 303, 304 Junior and Senior Electives **1 (0-2) f s**

Note: Juniors and seniors may elect any activity from the Controlled Elective Sports Area in which they have not previously received credit. Transfer students and veterans who cannot swim will be urged to elect beginning swimming.

ACTIVITIES IN PRESCRIBED SPORTS AREA

COURSES

Beginning Swimming: Offered in the fall semester. A course designed for meeting the college requirement and for preparing the student for Intermediate Swimming.

Fundamental Sports: Offered in the fall and spring. A course designed for the low skilled student where a particular type of activity can be given to meet his special needs.

Basic Sports: Offered in the fall and spring semesters. A course designed to acquaint the medium skilled student with appropriate activities in both team and individual self-testing items.

Hygiene: Offered in the second half of the fall semester, and in the first half of the spring semester. A course designed to guide the student to a more healthful way of life.

ACTIVITIES IN ELECTIVE SPORTS AREA

COURSES: TEAM SPORTS

Basketball: Offered in the second half of the fall semester and in the first half of the spring semester. A course designed to cover the fundamentals of shooting, offensive and defensive strategy, history and rules.

Football (touch): Offered in the first half of the fall semester. A course designed to cover the fundamentals of offensive and defensive play.

Soccer: Offered in the first half of the fall semester. A course designed to acquaint the student with the fundamental skills and to provide out-of-door activity in a team sport.

Softball: Offered in the second half of the spring semester. A course designed to include the fundamentals, history and rules of the game.

Volleyball: Offered in the first half of the fall semester, and in the entire spring semester. A course designed to include the fundamntals, history and rules of the game.

COURSES: INDIVIDUAL SPORTS

Angling: Offered in the first half of the fall semester, and the second half of the spring semester. A course designed to teach the fundamentals of spin, fly and bait casting, and an understanding of the game of skish.

Badminton: Offered in the second half of the spring semester. A course designed to give the beginner a thorough knowledge of the basic strokes and a general knowledge of the history, rules and strategy of the game.

Bowling (Duck Pins): Offered in the second half of the fall semester and in the first half of the spring semester. Fundamentals of the stance, approach and delivery are taught, together with rules, history, scoring and general theory of spare coverage. Students take turns setting pins. (Fee $2.50).

Bowling (Ten Pins): Offered in the first and second half of the fall semester, and in the first half of the spring semester. Fundamentals of ball selection, grip, stance and delivery are taught, together with rules, history, scoring and general theory of spare coverage. Students take turns setting pins. (Fee $2.50).

Boxing: Offered in the second half of the fall semester. A course designed to acquaint the student with the fundamentals, history and rules, with special emphasis on defensive techniques.

Golf: Offered in the first half of the fall semester and in the second half of the spring semester. A course designed for the beginner; grip, stance, swing and use of the various clubs, together with the history and etiquette of play.

Gymnastics: Offered in the second half of the fall semester and in the first half of the spring semester. A course designed to include the fundamentals of simple gymnastic stunts on the parallel bars, side horse, high bar, ropes and mats, together with history and rules.

Handball: Offered in both fall and spring semesters. A course designed to include the fundamentals, together with history and rules of handball.

Roller Skating: Offered during the second half of the fall semester and the first half of the spring semester. A course designed to teach the fundamentals of roller skating. Emphasis will be on body balance and control.

Swimming (Intermediate) Offered in both fall and spring semesters. A course designed to give the student competence in four basic strokes and two dives, preparatory to the Life Saving Program.

Swimming (Senior Red Cross Life Saving): Offered in the fall and spring semesters. Prerequisite: Intermediate Swimming or the equivalent. A course designed to qualify students for a Senior Red Cross Life Saving certificate and the possibility of a Water Safety Instructor's rating.

Swimming (Red Cross Instructor's): Offered in the fall and spring semesters. Prerequisite: A certificate for Senior Red Cross Life Saving. A course designed to qualify students for a Water Safety Instructor's rating.

Tennis (Beginning): Offered in the first half of the fall semester and in the second half of the spring semester. A course designed to give the beginner a thorough knowledge of the fundamental strokes and a general knowledge of the history rules and basic strategy of the game.

Tennis (Advanced): Offered in the first half of the fall semester and in the second half of the spring semester. Prerequisite: Beginning Tennis or its equivalent. Basic strokes are reviewed and the more difficult strokes taught. Emphasis is placed upon strategy during play and upon a more factual knowledge of the game and court etiquette.

Track and Field: Offered during the first half of the fall semester and second half of the spring semester. A course designed to develop knowledge, skill and interest in track and field events.

Wrestling: Offered in the first half of the fall semester and the first half of the spring semester. A course designed to give the fundamentals, history and rules of wrestling.

VARSITY SPORTS

Note: students may elect with the approval of the coach, the below listed varsity sports:

Baseball
Basketball
Cross-Country Track
Football
Golf
Soccer
Swimming
Track
Wrestling

PHYSICS

COURSES FOR UNDERGRADUATES

PY 201 202 GENERAL PHYSICS **5 (3-4) f s; f s**
Co-requisite MA 201
Required of sophomores in Engineering. A study of General Physics in which an analytical approach to the Principles of Physics is used. Emphasis is placed on problem solution and engineering applications. Recitations, demonstrated lectures, problem drill, and laboratory work are coordinated to give a working knowledge of the basic principles of physics. Py 201, mechanics, sound, and heat; Py 202, electricity, light, and modern physics.

PY 211, 212 GENERAL PHYSICS **4 (3-3) f s; s**
Prerequisite: MA 111
Recitations with demonstrations and laboratory work. Py 211, mechanics and heat; Py 212, sound, light, and electricity.

PY 223 ASTRONOMY AND ASTROPHYSICS **3 (3-0) s**
Prerequisites: Py 211 or 201 and 102
An introductory course in descriptive and physical astronomy. An introduction to the solar system, with some attention to constellations and star groups. Most of time is given to study of physical aspects of stars and star groups, including studies in brightness, temperature, energy and composition. Some time given to galaxies and inter-galactic space, with emphasis of nuclear fission and fusion and radio-astronomy. Observations using 5-inch refractor.

PY 311 LIGHT AND COLOR IN INDUSTRY **2 (2-0) f s**
Prerequisite: PY 212
Survey of the fundamental principles of light and radiation; photometry, illumination and distribution of light; lighting calculations; fluorescent lighting; the physiological and psychological aspects of light and color; color theories, standardization of color; color contrast, and color harmony. Special emphasis placed on development of color harmony.

PY 322 DESCRIPTIVE METEOROLOGY **2 (2-0) f**
Prerequisite: PY 212
Explanation of the weather and associated phenomena at an introductory level. Structure of the atmosphere; instrumentation; heat balance and primary circulation of the atmosphere; air masses, fronts, and waves; tertiary circulations; atmosphere of the lowest 10 meters.

PY 323 APPLIED METEOROLOGY **2 (2-0) s**
Prerequisite: PY 322
Technique of application of meteorological data to problems in Engineering, Agriculture, Forestry, etc., where weather is a factor, using principle of expectations as the basis for analysis. Examples from several fields as illustrations of various analysis techniques.

PY 327 LABORATORY TECHNIQUES IN PHOTOGRAPHY **3 (2-3) f**
Prerequisite: PY 212 or equivalent
A treatment of the general principles of photography with special applications in the fields of spectrography, micrography, Roentgenology, and nuclear physics.

PY 401, 402 INTERMEDIATE PHYSICS I **4 (3-3) f s**
Co-requisite: MA 401
Mechanics (401), heat, and sound (402) on an intermediate level. Intermediate Physics I, together with Intermediate Physics II (403, 404), constitutes on integrated study of classical physics at the next level above general sophomore phyics. Lectures, problems, and recitations, and one laboratory each week.

PY 403, 404 INTERMEDIATE PHYSICS II **4 (3-3) f s**
Co-requisite: MA 401
Electricity and magnetism (403), and optics (404) on an intermediate level. Intermediate Physics II, together with Intermediate Physics I, constitutes an integrated study of classical physics at the next level above general sophomore physics. Lectures, problems, recitations, and one laboratory each week.

PY 407 INTRODUCTION TO MODERN PHYSICS **3 (3-0) f s**
Prerequisites: PY 202, MA 202
A brief survey of the important developments in atomic and nuclear physics. Topics covered include: atomic and molecular structure, determination of the mass and charge of ions, origin of spectra, ion accelerators, nuclear reactions, and cosmic rays. Particular attention is paid to the practical applications of these developments.

PY 410 NUCLEAR PHYSICS I **4 (3-3) f s**
Prerequisite: PY 407
An introductory treatment of the properties of nuclear particles and their interactions with matter. Consideration is given to natural and artificial radioactivity, nuclear reactions, fission, and the structure of simple nuclei.

PY 419 INTRODUCTION TO NUCLEAR ENGINEERING **2 (2-0) f**
Prerequisite: PY 410
A survey of the engineering applications of nuclear energy. The principles and practices of isotope separation, production of plutonium, and nuclear reactor operation are studied along with the peace-time uses of products and by-products of nuclear reactors. Major engineering problems involved in each phase of the study are defined and the special methods of approach indicated.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PY 501 WAVE MECHANICS AND APPLICATIONS **3 (3-0) f**
Prerequisites: PY 407 and MA 401
An introductory course in wave mechanics with applications to the free particle, harmonic oscillator, rigid rotator, and the hydrogen atom. Includes discussion of approximation methods in the solutions of other problems. Primarily designed for a one semester introduction to wave mechanics for those students not specializing in theoretical physics.

PY 510 NUCLEAR PHYSICS II **4 (3-3) s**
Prerequisite: PY 410
A continuation of Physics 410 with particular emphasis on neutron physics, nuclear energy levels, meson theory, nuclear resonance, atomic and molecular magnetism, and cosmic radiation.

PY 518 RADIATION HAZARD AND PROTECTION **3 (3-0) f s**
Prerequisite: Py 410
The hazards from enternal exposure to ionizing radiation are evaluated. The dosages resulting from the ingestion of radioactive materials are computed. The precautionary methods used in radioactive work are presented. Selected biological effects of ionizing radiation are studied.

PY 520 PHYSICAL TECHNOLOGY IN RADIOACTIVITY **3 (2-3) f s**
Prerequisite: PY 410
Emphasis in this course is on laboratory practices in detecting, handling, and quantitatively measuring radioactive samples. The preparation of samples for radioactivity measurements and the calculation methods used in analyzing such data are summarized.

PY 526 IONIZATION PHENOMENA AND ELECTRON OPTICS **2 (2-0) s**
Prerequisites PY 404, 410
Methods of producing ions, and the interaction of ions with electric and magnetic fields are discussed, together with a brief survey of the present status of electron optics.

PY 530 ELEMENTARY NUCLEAR REACTOR THEORY **3 (3-0) s**
Prerequisites: PY 410; MA 511 or 532
A lecture course in the principles of chain reactors. Slowing down of neutrons, neutron diffusion equations, space distribution of neutrons, conditions for criticality, reactor dimensions for simple geometries, elementary group theories, and time dependent reactor behavior.

PY 531 NUCLEAR REACTOR LABORATORY **1 (0-3) f s**
Co-requisite: PY 530, PY 518 except by permission
Observations on and measurements on the behavior of the nuclear reactor, and correlation with reactor theory. Experiments with apparatus involving the motion and detection of neutrons. Foil measurements of neutron flux. Irradiations in the reactor of samples to produce radioisotopes.

PY 541, 542 ADVANCED EXPERIMENTS IN PHYSICS **1 (0-3) f s**
Prerequisites: PY 202, MA 202
Covers the techniques and theory of selected experiments in mechanics, heat, sound, light, or electricity. The treatment and interpretation of data are stressed.

PY 544 VIBRATION AND WAVE MOTION **3 (3-0) f**
Prerequisites: PY 202, MA 401
The dynamics of vibratory and oscillatory motion. Analogies in mechanical, electrical and acoustical vibrating systems. Analysis of wave motion and propagation in different media.

PHYSICS

PY 545 APPLIED ACOUSTICS **3 (3-0) s**
Prerequisite: PY 544
The dynamical theory of sound. Sources of sound, measurement of sound intensity, measurement of frequency, acoustical impedance and transmission of sound, sound filters and resonators, acoustics of speech and hearing, reception and reproduction of sound, acoustics of buildings.

PY 551 INTRODUCTION TO X-RAYS **3 (2-3) f**
Prerequisites: PY 202, MA 202
Origin, production, absorption, single crystal diffraction, and powder diffraction of X-rays are studied. These basic topics are then applied to detection of defects in welds and castings and to the determination of crystal structure and particle and fiber size.

PY 552 INTRODUCTION TO THE STRUCTURE OF SOLIDS: CRYSTALLOGRAPHY **3 (3-0) s**
Prerequisites: PY 202, MA 202; PY 551 recommended
Elementary consideration of amorphous and crystalline solids, metal conductors, and semiconductors. Some optical crystallography is included.

COURSES FOR GRADUATES ONLY

PY 601, 602 ADVANCED GENERAL PHYSICS **3 (3-0) f s**
Prerequisites: PY 401, MA 511
Mathematical and theoretical approach to relationships between the various branches of physics, with applications to mechanical, electrical, optical, thermal, and vibratory problems. Generalization of underlying physical principles.

PY 610 ADVANCED NUCLEAR PHYSICS **3 (3-0) f**
Prerequisite: PY 410; PY 611, except by permission
Current hypotheses of nuclear structure and reactions, including fission, theories of alpha emission, deuteron binding, neutron-proton scattering, the compound nucleus, and beta-decay. The use of neutrons in present day nuclear research is emphasized.

PY 611 612 QUANTUM MECHANICS **3 (3-0) f s**
Prerequisites: PY 407, MA 532
Theory of quantum mechanics with applications to atomic and molecular structure, scattering phenomena, and the interaction of radiation with matter.

PY 619 HETEROGENEOUS REACTOR DESIGN **3 (3-0) f**
Prerequisite: PY 530
Design analysis of heterogeneous power reactors. Theory of resonance capture, thermal utilization and flux distributions in multi-region systems. Transient and steady state poison effects. Heat transfer limitations in reactors. Evaluation of materials of construction, coolants and fuels. One-velocity transport theory.

PY 621 KINETIC THEORY OF GASES **3 (3-0) f**
Prerequisites: PY 202, MA 511
The theory of molecular motion, including the velocity and density distribution functions, the phenomena of viscosity, heat conduction and diffusion; equations of state; fluctuations.

PY 622 STATISTICAL MECHANICS **3 (3-0) s**
Prerequisites: PY 400, MA 511; PY 621, except by permission
A treatment of statistical mechanics from both the quantum and classical point of view. Development of theories from the thermodynamical standpoint and their practical application.

PY 630 HOMOGENEOUS REACTOR DESIGN **3 (3-0) s**
Prerequisite: PY 530
Calculations of critical loading of homogeneous power reactors, flux distribution, control rod values, theory of two and multigroup methods and evaluation of group constants. Uses and limitations of age and diffusion theory. Energy dependent transport theory. The time-dependent behavior of a reactor with negative temperature coefficient.

PY 631, 632 ATOMIC AND MOLECULAR SPECTRA **3 (3-0) f s**
Prerequisite: PY 404
Co-requisites: PY 611, MA 532
Atomic models and coupling schemes. Multiplet series, Zeeman, Paschen-Back, and Stark effects. Hyperfine structure and complex spectra. Spectra of polyatomic molecules. Infrared and Raman Spectra. Applications adapted to the interests of the students in the course.

PY 661, 662 THE SOLID STATE **3 (3-0) f s**
Prerequisite: PY 552
The electron theory of conduction, electrical and thermal conduction in solids, and surface phenomena, with applications to physical behavior and usage of solids.

PY 670 SEMINAR **1 (0-3) f s**
Literature surveys, written and oral presentation of papers on special topics.

PY 690 RESEARCH **Credits by arrangement**
Graduate students sufficiently prepared may undertake research in some selected field of Physics.

PLANT PATHOLOGY

COURSES FOR UNDERGRADUATES

PP 315 PLANT DISEASES **3 (2-3) f**
Prerequisites: BO 101, 102
The nature and symptoms of disease in plants and the characteristics of important plant pathogenic nematodes, viruses, bacteria, and fungi are studied. An understanding of the important concepts and methods of disease control is developed, based on a knowledge of major types of plant diseases.

Mr. Kelman

PP 318 DISEASES OF FOREST TREES **3 (2-3) s**
Prerequisites: BO 101, 102
The nature and symptoms of major types of tree diseases and the important characteristics of their causal agents are studied. Emphasis is placed on the influence of environmental factors on disease development as well as the basic principles and methods of control.

Mr. Kelman

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PP 503 DIAGNOSIS OF PLANT DISEASES **3 (1-4) summer**
Prerequisites: One advanced course in Plant Pathology and permission of instructor
A study of techniques used in plant disease diagnosis with emphasis on diagnostic value of signs and symptoms for certain types of diseases. Consideration will be given to major sources of descriptive information on plant pathogens and the use of keys for the identification of fungi.
(Offered in 1958 and alternate years)

Mr. Hebert

PP 504 PLANT PARASITIC NEMATODES **2 (1-3) f**
Prerequisites: PP 315
A study of morphology, anatomy, physiology and taxonomy of plant parasitic nematodes. Methods of isolating nematodes from soil and plant parts and other laboratory techniques used in the study and identification of nematodes will be considered.

Miss Hirschmann

PP 515 DISEASES OF FIELD CROPS **3 (2-2) s**
Prerequisites: PP 315
An advanced study of the more important diseases of North Carolina field crops such as cotton, corn, tobacco, soybeans, alfalfa, clover, grasses and small grains with major emphasis on identification, cause and control.

Mr. Lucas

PP 516 DISEASES OF FRUIT CROPS **3 (2-2) s**
Prerequisites: PP 315
Study of causes, symptoms, epiphytology, and principles of control of major diseases of pome, stone, nut, and berry crops.
(Offered in 1957-58 and alternate years)

Mr. Clayton

PP 517 DISEASES OF VEGETABLE CROPS **3 (2-2) s**
Prerequisite: PP 315
Studies designed to provide the student with a working knowledge of the etiology, symptomatology, epiphytology, and control of major vegetable crop diseases.
(Offered in 1958-59 and alternate years) Mr. Winstead

POULTRY

COURSES FOR GRADUATES ONLY

PP 601 PHYTOPATHOLOGY I **4 (1-6) f**
Prerequisites: PP 315 and permission of the instructor
A study of the principles of phytopathological research. The course is designed to apply the classical scientific method to disease investigation. Exercises will include appraising disease problems, reviewing literature, laboratory and greenhouse experiments and the evaluation and persentation of data.
Mr. Apple

PP 602 PHYTOPATHOLOGY II **4 (2-6) s**
Prerequisites: PP 315 and permission of the instructor
The basic concepts of the etiology, pathology, epiphytology and control of plant diseases. (Offered in 1958-59 and alternate years)
Mr. Nusbaum

PP 611 NEMATODE DISEASES OF PLANTS **3 (1-4) s**
Prerequisites: PP 504
A study of plant diseases caused by nematodes. Special consideration will be given to host-parasite relationships, host ranges, and life cycles of the more important economic species. Principles and methods of control will be considered.
Mr. Sasser

PP 615 RESEARCH IN PLANT PATHOLOGY **Credits by arrangement**
Prerequisites: Graduate standing and consent of adviser
Original research in connection with a thesis problem in Plant Pathology.
Graduate Staff

PP 617 SPECIAL PROBLEMS IN PLANT PATHOLOGY **Credits by arrangement**
Prerequisites: Graduate standing and consent of the instructor
Original research on special problems in Plant Pathology not related to a thesis problem but designed to provide experience and training in research.
Graduate Staff

PP 625 SEMINAR IN PLANT PATHOLOGY **1 (1-0) f s**
Prerequisite: Consent of seminar chairman
Discussion of phytopathological topics selected and assigned by seminar chairman.
Graduate Staff

POLITICAL SCIENCE

SEE HISTORY AND POLITICAL SCIENCE

POULTRY

COURSES FOR UNDERGRADUATES

PO 201 POULTRY PRODUCTION **4 (3-3) f s**
Prerequisites: Required of majors in Poultry Science
Elective for others
Principles of broiler, market eggs, hatching egg and turkey production. Classes, breeds and varieties identification of chickens and turkeys. Breeding, incubation, raising, housing, feeding, disease and parasite control, marketing of chickens, eggs and turkeys.
Messrs. Brown, Martin

PO 301 POULTRY JUDGING **2 (1-3) f**
Prerequisite: Required of majors in Poultry Science
Elective for others with permission of instructor
Judging of poultry for egg production, breeding and market qualities; judging dressed market carcasses and eggs.
Messrs. Brown, Bumgardner

PO 303 BIOLOGY OF THE FOWL **3 (1-6) s**
Prerequisites: Required of majors in Poultry Science
Elective for others with permission of instructor
A foundation course for juniors and senior poultry courses. Macroscopic embryology of the chick. Dissection and study of the gross anatomy of the chicken and turkey. Physiology of the tissues and organs. Endocrine control of reproduction. Formation and structure of the egg.
Mr. Bumgardner

PO 351 ADVANCED POULTRY JUDGING **1 (0-3) f**
Prerequisites: PO 301 Elective for majors in Poultry Science and for others with permission of instructor
Course consists of laboratory work for further practice and proficiency in poultry and egg judging.

Messrs. Brown, Bumgardner

PO 401 POULTRY DISEASES **4 (3-3) s**
Prerequisites: Required of majors in Poultry Science
Elective for others with permission of instructor
The major infectious, non-infectious and parasitic diseases of poultry are studied with respect to economic importance, etiology, susceptibility, dissemination, symptoms, lesions and diagnostic methods. Emphasis is placed upon practices necessary for the prevention, control and treatment of each disease.

Mr. Barber

PO 402 COMMERCIAL POULTRY FARM AND HATCHERY MANAGEMENT **4 (3-2) s**
Prerequisites: Required of majors in Poultry Science
Elective for others with permission of instructor
Principles of incubation of chicken and turkey eggs; hatchery management; Organization and development of plans for the operation and maintenance of a commercial poultry farm for meat and egg production; study of the types of buildings, equipment and methods of management currently employed by successful poultrymen in North Carolina. Problem.

Mr. Brown

PO 403 POULTRY SEMINAR **1 (1-0) f s**
Prerequisite: Required of seniors in Poultry Science
Current topics and problems relating to Poultry Science and to the poultry industry are assigned for oral report and discussion. Two semesters.

Staff

PO 404 POULTRY PRODUCTS **3 (2-3) f**
Prerequisites: ZO 101 or 102, CH 101
Required of majors in Poultry Science
Elective for others with permission of instructor
Selection, processing, grading, and packaging poultry meat and eggs. Factors involved in preservation of poultry meat and eggs.

Mr. Fromm

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PO 520 POULTRY BREEDING **3 (2-3) f**
Prerequisites: GN 411
Required of majors in Poultry Science
Elective for others with permission of instructor
Application of genetic principles to poultry breeding, considering physical traits and physiological characteristics—feather patterns, egg production, hatchability, growth, body conformation and utility.

Messrs. Glazener, Martin

PO 521 POULTRY NUTRITION **3 (2-3) f**
Prerequisites: CH 203, 451
Required of majors in Poultry Science
Elective for others with permission of instructor
A study of proteins, carbohydrates, fats, minerals and vitamins requried for growth, egg production and reproduction in the chicken and turkey. Symptoms and lesions induced by nutritional deficiencies. Compounding different types of poultry mashes and methods of feeding these mashes. The production of certain vitamin and mineral deficiencies in chicks for observation and examination.

Mr. Kelly

PO 522 ENDOCRINOLOGY OF THE FOWL **3 (2-3) s**
Prerequisites: ZO 301 or equivalent
The endocrine system is studied with respect to its physiological importance in such intricate processes as metabolism, growth and reproduction. Emphasis is placed upon this system for the fowl, but mammalian examples are also used to illustrate basic concepts of the science. The interests of the students will be considered in the selection of illustrative material.

Mr. Garren

COURSES FOR GRADUATES ONLY

Graduate courses may not be offered if registration for the course is too low or if the faculty or facilities become unavailable.

PO 601 ADVANCED POULTRY BREEDING **3 (3-0) arrange**
Prerequisites: ST 511, 512; PO 520
Study of lethal, skeletal, and feather variations. Linkage and chromosome mapping of the fowl. Theory and contemporary ideas concerning breeding for meat and egg production in the fowl.

Mr. Blow

PO 602 ADVANCED POULTRY NUTRITION **3 (0-6) arrange**
Prerequisites: PO 521, CH 511 or equivalent
Students taking this course will conduct a research problem in poultry nutrition. This problem will involve the designing and carrying out of microbiological and chick experiments. The students will obtain practice in correlating results obtained in microbiological and chick assays.

Mr. Hill

PO 603 ADVANCED POULTRY HEMATOLOGY **3 (0-6) arrange**
Prerequisites: Graduate standing; permission of instructor
Study of the hematopoietic system and blood formation in the chicken. The erythrocyte, the leucocyte, the thrombocyte, the bone marrow cells and their respective systems. Technics of blood and marrow examination. Quantitative and qualitative variations in the cells and their constituents. Mechanisms producing such variations, causes and effects.

Mr. Cook

PO 604 ADVANCED POULTRY DISEASES **3 (0-6) arrange**
Prerequisites: ZO 452, 545
Graduate standing
Fundamentals of general pathology. Special pathology of infectious and nutritional diseases of the fowl. Study and interpretations of changes in the macroscopic and microscopic structures of the diseased tissues and organs of the fowl occurring under field and experimental conditions. The role of hematology, immunology and endocrinology in the diagnosis and prevention of poultry diseases.

Mr. Barber

PO 611 POULTRY RESEARCH **1-6 (arrange) f s**
Credits: A maximum of six is allowed toward a Master's degree
Prerequisite: Graduate standing
Appraisal of present research, critical study of some particular problem involving original investigation. Problems in poultry breeding, nutrition, disease, endocrinology, hematology or microbiology.

Graduate Staff

PO 613 SPECIAL PROBLEMS IN POULTRY SCIENCE **1-6 (arrange) f s**
Prerequisites: Graduate standing
Specific problems of study are assigned in various phases of poultry science.

Graduate Staff

PSYCHOLOGY

COURSES FOR UNDERGRADUATES

PSY 200 INTRODUCTION TO PSYCHOLOGY **3 (3-0) f s**
A study of the general characteristics and development of human behavior, emphasizing the problems of motivation, emotion, learning and thinking.

Staff

PSY 201 ELEMENTARY EXPERIMENTAL PSYCHOLOGY **3 (2-3) f**
Prerequisite: PSY 200
Introduction to experimental psychology. Two lectures and one laboratory period per week.

Messrs. Barkley, Cook, Newman

PSY 302 PSYCHOLOGY OF PERSONALITY AND ADJUSTMENT **3 (3-0) f**
Prerequisite: PSY 200
A study of the factors involved in the development of the normal personality, emphasizing the principal factors controlling human behavior and their relationship to adjustment mechanisms.

Mr. Corter

PSY 304 EDUCATIONAL PSYCHOLOGY **3 (3-0) f**
PSY 200 recommended as an introductory course
Applications of psychology to education; problems of learning, motivation, interests; the measurement of educational efficiency; mental hygiene.

Messrs. Johnson, Barkley, Newman

PSY 307 GENERAL APPLIED PSYCHOLOGY **2 (2-0) s**
Prerequisite: PSY 200
A study of the application of principles of psychology in medicine, law, advertising, selling, vocational guidance, the arts and athletics.

Mr. Barkley

PSY 337 INDUSTRIAL PSYCHOLOGY I **3 (3-0) f s**
Prerequisite: PSY 200
The application of psychological principles to the problems of modern industry; methods of work, monotony, fatigue, accidents, motivation and morale of workers.

Staff

COURSES FOR ADVANCED UNDERGRADUATES

PSY 438 INDUSTRIAL PSYCHOLOGY II **3 (3-0) s**
Prerequisite: PSY 200, 337
The application of psychological principles to the problems of modern industry; selection, placement and training of workers.
Mr. Askren

PSY 441 HUMAN FACTORS IN EQUIPMENT DESIGN **3 (3-0) s**
Prerequisite: PSY 200
Human factors in the design of machines and other equipment. Sensing, computing and controlling as human functions which have been extended to machines. Human characteristics which affect equipment design. A "systems analysis" approach to man-machine problems, in which man and machine are considered as a whole.
Messrs. Cook, Gray

PSY 464 VISUAL PERCEPTION FOR DESIGNERS **3 (3-0) f**
Prerequisite: PSY 200
The nature of the seeing process and its relation to architecture, industrial arts and to the industrial, engineering and textile design fields. Topics include the physical basis of sight, perception of color and form, vision and illumination, psychological factors in visual design and a unit of training planned to improve the student's ability to perceive visual form.
Mr. Cook

PSY 475 CHILD PSYCHOLOGY **3 (3-0)**
Prerequisite: PSY 200 or 304
Course offered during Summer session only
The development of the individual child of the elementary school age will be the inclusive subject of study in this course. Emphasis will be placed upon the intellectual, social, emotional and personality development of the child. Physical growth will be emphasized as necessary to an understanding of the psychological development of the pupil.
Mr. Barkley

PSY 476 PSYCHOLOGY OF ADOLESCENCE **2 (2-0) s**
Prerequisite: PSY 200 or 304
Mental growth, social development and interests of adolescent boys and girls.
Messrs. Johnson, Barkley

PSY 490 SOCIAL PSYCHOLOGY **3 (3-0) s**
Prerequisite: PSY 200
Social applications of psychology; social stimulation, response and attitudes.
Messrs. Barkley, Miller

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PSY 501 INTERMEDIATE APPLIED EXPERIMENTAL PSYCHOLOGY **3 (2-3) f or s**
Prerequisite: PSY 200 and six additional hours in Psychology
Experimental study of problems in the major areas of general and theoretical psychology which have special significance in educational, industrial and applied social psychology. Emphasis will be placed upon description of problems, study of methods, design of experiments and procedures for the analysis and presentation of data. Two lectures and one laboratory period per week.
Messrs. Barkley and Cook

PSY 504 ADVANCED EDUCATIONAL PSYCHOLOGY **3 (3-0) s**
Prerequisite: Four hours in Psychology
Course offered in alternate years
An advanced course giving a critical appraisal and a consideration of the practical applications for vocational education of modern psychological findings.
Messrs. Johnson, Barkley, Newman

PSY 511 ADVANCED SOCIAL PSYCHOLOGY **3 (3-0) s**
Prerequisites: PSY 200 and six additional hours in Psychology
Course offered in alternate years
A study of social relationships and their psychological bases; emphasis on those aspects of behavior determined by personal interactions; work will involve analysis of representatives research studies, and doing individual projects in industrial and rural areas.
Messrs. Barkley, Miller

PSY 530 ABNORMAL PSYCHOLOGY **3 (3-0) s**
Prerequisites: PSY 200, 302
A study of the causes, symptomatic behavior and treatment of the major personality disturbances, with emphasis placed on preventive mental hygiene methods.
Mr. Corter

PSYCHOLOGY

PSY 535 TESTS AND MEASUREMENTS **3 (3-0) f**
Prerequisite: Three hours in Psychology
A study of available tests, with emphasis on proper selection and use of testing instruments; also a study of statistical procedures needed in the proper use of tests, including measures of central tendency, variability and correlation.
Messrs. Corter, Johnson

PSY 550 MENTAL HYGIENE IN TEACHING **3 (3-0) f**
Prerequisite: Four hours in Psychology
A survey of mental hygiene principles applicable to teachers and pupils; practical problems in prevention and treatment of psychological problems in schools; case studies and research.
Messrs. Barkley, Corter

PSY 560 TEST CONSTRUCTION **3 (3-0) f**
Prerequisites: Twelve hours in Psychology including Intermediate Statistics (ST 513 or equivalent)
Course offered in alternate years
Analyzes the steps necessary for the development of tests, including job analysis, test development of different types of items, item analysis, establishment of norms and determintion of reliability. Emphasis placed on construction of mechanical tests with application to industry. Students will be given opportunity for construction of tests.
Mr. Gray

PSY 565 INDUSTRIAL MANAGEMENT PSYCHOLOGY **3 (3-0) f or s**
Prerequisites: PSY 200 and three additional hours in Psychology
This course is designed for management personnel in industry and graduate students in psychology who wish to familiarize themselves with industrial problems. Emphasis will be placed on principles and methods for obtaining better utilization of employee resources of ideas, attitudes and motivations.
Mr. Miller

PSY 570 INTELLIGENCE: THEORY AND MEASUREMENT I **3 (3-0) f**
Prerequisites: PSY 200 and three additional hours in Psychology
An introduction to individual intelligence testing, theoretical background of intelligence testing, clinical introduction to intelligence testing, case studies and research.
Mr. Corter

PSY 571 INTELLIGENCE: THEORY AND MEASUREMENT II **3 (3-0) s**
Prerequisite: PSY 570
A practicum in individual adult intelligence testing with emphasis on the Wechsler-Bellevue, other performance tests of intelligence, report writing and case studies.
Mr. Corter

PSY 572 INTELLIGENCE: THEORY AND MEASUREMENT III **3 (3-0)**
Prerequisite: PSY 570
Course offered during Summer session only
A practicum in individual intelligence testing of infants, children and adults with emphasis on the Stanford-Binet, other tests, report writing, case studies and consultation with teachers.
Mr. Corter

PSY 576 ADVANCED ADOLESCENT PSYCHOLOGY **3 (3-0) s**
Prerequisite: PSY 476
An advanced course in psychology of adolescence in which the student considers the original work of leaders in this field, thus laying the foundation for a critical appreciation of the new studies that are constantly appearing.
Mr. Johnson

PSY 578 INDIVIDUAL DIFFERENCES **3 (3-0) f**
Prerequisite: Four hours in Psychology
Nature, extent and practical implications of individual differences and individual variation.
Mr. Barkley

COURSES FOR GRADUATES ONLY

PSY 604 APPLIED EXPERIMENTAL PSYCHOLOGY **3 (2-3) f or s**
Prerequisite: Eight hours in Psychology including experimental psychology
Experimental analysis of problems of sensation, perception, learning, thinking, emotions, fatigue and neuro-muscular reactions. Emphasis upon methods of experimental control, design of experimental apparatus and accuracy of reports as these are related to laboratory investigations in the fields of applied psychology.
Messrs. Barkley, Cook

PSY 607 ADVANCED INDUSTRIAL PSYCHOLOGY I **3 (3-0) f**
Prerequisite: Eight hours in Psychology
Discussion, analysis and evaluation of psychological problems in industry; training, selection and placement of the worker. Emphasis on current research and study of psychological programs operating in different industries.
Messrs. Askren, McGehee, Miller

PSY 608 ADVANCED INDUSTRIAL PSYCHOLOGY II **3 (3-0) s**
Prerequisite: Eight hours in Psychology
Discussion, analysis and evaluation of psychological problems in industry; morale, attitudes, fatigue, accidents and maladjusted workers. Emphasis on current research and study of psychological programs operating in different industries.
Messrs. Askren, McGehee, Miller

PSY 609 PSYCHOLOGICAL CLINIC PRACTICUM **Maximum 3 hours f s**
Prerequisite: Eight hours in Psychology
Clinical participation in interviewing, counseling, psychotherapy and administration of psychological tests. Practicum to be concerned with college students, adults and children.
Mr. Corter

PSY 610 APPLIED IMPLICATIONS OF THEORIES OF LEARNING **3 (3-0) s**
Prerequisite: Eight hours in Psychology
Course offered in alternate years
A study of theories of learning with emphasis upon applications of the principles of learning in industrial and school situations.
Messrs. Barkley, Johnson, Newman, Cook

PSY 612 SEMINAR IN INDUSTRIAL PSYCHOLOGY **3 (3-0) s**
Prerequisite: Eight hours in Psychology
Scientific articles, analysis of experimental designs in industrial psychology and study of special problems of interest to graduate students in Industrial Psychology.
Graduate Staff

PSY 613 RESEARCH IN PSYCHOLOGY **Credits by arrangement**
Prerequisite: Eight hours in Psychology
Individual or group research problems; a maximum of six credits is allowed toward the Master's degree.
Graduate Staff

RURAL SOCIOLOGY

COURSES FOR UNDERGRADUATES*

RS 204 NORTH CAROLINA RURAL LIFE **2 (2-0) f s**
Introduction to the specific patterns of rural living in North Carolina; structure and function of the groups in which North Carolina rural people participate; major social institutions and their related problems; and organized efforts to improve community life in the state.
Staff

RS 301 SOCIOLOGY OF RURAL LIFE **3 (3-0) f s**
Prerequisite: Completion of the freshman year
A systematic sociological analysis of the characteristics, institutions and problems of rural life. Part I is a brief description of the basic concepts, the theoretical framework and the method of analysis of institutions and problems. Part II consists of systematic analyses of the major social institutions and their respective problems. Part III portrays the role of the community as an area of institutional functioning and societal integration.
Staff

RS 321 INTRODUCTION TO SOCIAL RESEARCH **2 (2-0) f s**
Prerequisite: RS 301
Designed to give the student a basic understanding of the methods of sociological research. Reviews the scientific method and its application to the design of social research including the collection, analysis, and interpretation of social data. Appropriate ways of presenting the findings and of making the greatest use of the data are presented. Critical and objective thinking are stressed throughout the course.
Messrs. Young and Mayo

RS 322 INTRODUCTION TO RURAL SOCIAL WORK **3 (3-0) s**
Prerequisite: RS 301 or permission of the instructor
Constructed to acquaint the preprofessional student with the subject matter of social work as well as its related professional fields. Attention is given to three major areas: (1) case work in various settings; (2) group work, and (3) community organization. Public and private agencies which employ persons trained in social work are studied.
Mr. Mayo

RS 441 RURAL SOCIAL PATHOLOGY **3 (3-0) f**
Prerequisite: RS 301 or permission of the instructor
A study of major social problems in modern society: physical and mental health, family instability, crime and penology and minority group problems. A framework for analysis and understanding is presented and stressed throughout including a positive approach for pre-
Mr. Mayo

RURAL SOCIOLOGY

RS 442 RURAL SOCIAL STRUCTURE **3 (3-0) s**
Prerequisite: RS 301 or permission of the instructor
Social structure is viewed in its two major dimensions: (1) vertically through the concepts of social stratification; and (2) horizontally as a set of basic social institutions interacting by means of a system of concrete social organizations. Particular attention is given to the place of the rural segment in the total social system. The bases of social cohesion which permit diversity within a functioning whole are examined.
Mr. McCann

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES*

RS 511 RURAL POPULATION PROBLEMS **3 (3-0) f**
Prerequisite: RS 301
A study of population growth, rates of change and distribution. Considerable attention is given to the functional roles of population, i. e., age, sex, race, residence, occupation, marital status and education. The dynamic aspects of population are stressed: fertility, mortality and migration. Population policy is analyzed in relation to national and international goals. A world view is stressed throughout.
Mr. Mayo

RS 512 RURAL FAMILY LIVING **3 (3-0) s**
Prerequisite: RS 301
Values, patterns and levels of rural family living. Differentials and factors related thereto in the world, the nation and North Carolina. Analysis of selection problems, programs, policies and methods of study.
Mr. Hamilton

RS 513 COMMUNITY ORGANIZATION **3 (3-0) s**
Prerequisite: RS 301
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.
Mr. Mayo

RS 523 LAND TENURE SYSTEMS **3 (3-0) f**
Prerequisite: Permission of the instructor
A systematic sociological analysis of the major agricultural land tenure systems of the world with major emphasis on the problems of family farm ownership and tenancy in the United States.
Mr. Hamilton

RS 534 (Same as HI 534) FARMER'S MOVEMENTS **3 (3-0) s**
Prerequisite: 3 hours of Sociology
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 Non-partisan League, cooperative marketing, government programs and present problems.
Mr. Noblin

RS 541 SOCIAL AGENCIES AND PROGRAMS **3 (3-0) f**
Prerequisite: 3 hours of Sociology
Study of social agencies and programs and their implementation through specific organizations in dynamic relation with the people whom they serve. Consideration is given to the relation of these agencies and programs to community structure and forces in rural society; coordination of the several types of agencies and programs; professional leadership in the local community; and problems of stimuating local leadership and participation.
Mr. Mayo

COURSES FOR GRADUATES ONLY*

RS 611 RESEARCH METHODS IN SOCIOLOGY **3 (3-0) f**
Prerequisite: Permission of the instructor
Designed to give the student a mature insight into the nature of scientific research in sociology. Assesses the nature and purpose of research designs, the interrelationship of theory and research, the use of selected techniques and their relation to research designs, and the use of modern tabulation equipment in research.
Mr. McCann

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* Additional courses, suitable for rural sociology majors and graduates students, are listed below in the offerings of the Department of Sociology and Anthropolgy. Other sociology courses especially suitable for advanced students and graduates are offered by the Department of Sociology and Anthropology of the University at Chapel Hill.

RS 621 RURAL SOCIAL PSYCHOLOGY **3 (3-0) f**

Prerequisite: Permission of the instructor
Treats the genetic development of the rural personality and the interrelationship of the individual and the rural society. Studies the social psychological factors related to rural leadership, morale, social organization and social change, and examines the attitudes and opinions of rural people on current local and national issues.

Mr. McCann

RS 631 POPULATION ANALYSIS **3 (3-0) s**

Prerequisite: Permission of the instructor
Methods of describing, analyzing and presenting data on human populations: distribution, characteristics, natural increase, migration and trends in relation to resources.

Mr. Hamilton

RS 632 RURAL FAMILY **3 (3-0) f**

Prerequisite: Permission of the instructor
Emphasis is placed on the development of an adequate sociological frame of reference for family analysis; on discovering both the uniquely-cultural and common-human aspects of the family by means of cross-cultural comparisons; on historical explanations for variability in American families with especial concern for the rural family; and on analyzing patterns of family stability and effectiveness.

Mr. Hamilton

RS 633 THE RURAL COMMUNITY **3 (3-0) s**

Prerequisite: Permission of the instructor
The rural community is viewed in sociological perspective as a functioning entity. A method of analysis is presented and applied to eight "dimensions," with emphasis on the unique types of understanding to be derived from measuring each dimension. Finally, the effect of change on community integration and development is analyzed.

Mr. Mayo

RS 641 STATISTICS IN SOCIOLOGY **3 (3-0) f**

Prerequisite: ST 513
The application of statistical methods in sociological research. Emphasis on selecting appropriate models, instruments and techniques for the more frequently encountered problems and forms of data.

Mr. Hamilton

RS 642 RESEARCH IN RURAL SOCIOLOGY **Credits by arrangement**

Prerequisite: Permission of chairman of graduate study committee. (Maximum of six credits)
Planning and execution of research, and preparation of manuscript under supervision of graduate committee.

Graduate Staff

RS 652 COMPARATIVE RURAL SOCIETIES **3 (3-0) f**

Prerequisites: Permission of the instructor
Sociological analysis of rural societies around the world with particular reference to North and South America. Special emphasis is given to cultural and physical setting, population comparison, levels of living, relationship of the people to the land, structure and function of the major institutions and forces making for change.

Mr. Mayo

RS 653 THEORY AND DEVELOPMENT OF RURAL SOCIOLOGY **3 (3-0) s**

Prerequisite: Permission of the instructor
Required of all masters and doctoral candidates in Rural Sociology and recommended for all graduate minors. Designed to meet two objectives: (1) to introduce the student to the study of current sociological theory and (2) to survey events and trends in the historical development of rural sociology.

Mr. Hamilton

RS 671 SEMINAR **Credits by arrangement**

Appraisal of current literature; presentation of research papers by students; progress reports on departmental research; review of developing research methods and plans; reports from scientific meetings and conferences; other professional matters. (A maximum of three credits is allowed toward the master's degree, and six credits toward the doctorate.)

Graduate Staff

SOCIAL STUDIES

SS 301, 302 CONTEMPORARY CIVILIZATION **3 (3-0) f s**
Prerequisites: For engineering students ENG 205, HI 205, EC 205; for others, permission of the Department
An examination of the major concepts, methods and values that characterize modern thought in the fields of physical science, the humanities and the social sciences. The course utilizes the student's previous training, plus materials from the history and philosophy of science and the history of technology to demonstrate the essential interrelatedness of scientific, social, and aesthetic activity.

SS 491, 492 CONTEMPORARY ISSUES **3 (3-0) f s**
Prerequisites: For engineering students, SS 301, 302; for others, permission of the Department
This course deals with concrete current problems as they arise from day to day in the world of public affairs. These problems are studied and discussed in the context of a search for a more realistic definition of the limits of freedom and authority. Text materials are books, magazines and newspapers.

SOCIOLOGY AND ANTHROPOLOGY — — — — — — — —

COURSES FOR UNDERGRADUATES

ANT 205 PEOPLE OF THE WORLD **3 (3-0) f s**
This course seeks to develop insights of wide applicability concerning human relationships and the adjustment of man to his geographical, social, and cultural environments. The course is designed to demonstrate interrelationships among diverse factors affecting human behavior in all societies.

ANT 251 THE STUDY OF MAN **3 (3-0) f**
The study of the development of the man as a species; analysis of the formation and spread of races; introduction to archaeology as a study of the material remains of ancient man and his activities.

ANT 252 CULTURAL ANTHROPOLOGY **3 (3-0) s**
The analysis of various living societies and their cultures in terms of social adjustment to recurrent needs.

SOC 111, 112 THE AMERICAN WAY OF LIFE **2 (2-0) f s**
Designed to introduce foreign students to the culture of the United States. Students are helped to develop an understanding of the basic values and traditions of American society and an insight into the problems that confront it in the world today. Each semester is independent.

SOC 202 MAN AND SOCIETY (GENERAL SOCIOLOGY) **3 (3-0) f s**
Introduction to the scientific study of man's behavior in relation to other men, the general laws affecting the organization of such relationships and the effects of social life on human personality and behavior.

SOC 301 HUMAN BEHAVIOR **3 (3-0) f s**
A study of the effects of social interaction upon individual behavior and personality; collective attitudes and behavior as products of group experience; analysis of fashions and fads, crowds, mobs, public, social movements.

SOC 302 PUBLIC RELATIONS AND MODERN SOCIETY **3 (3-0) f s**
A study of the social and community setting of public relations, followed by a more intense analysis of the development and composition of social groups and the processes involved in group organization. General characteristics and techniques of leadership in the field of public relations are analyzed and tested in the classroom. The student will study the significance and function of mass communication media and the expansion of the social functions of technical specialists and executives. The course concludes with a consideration of the role of public relations in regional and international affairs.

SOC 303 CURRENT SOCIAL PROBLEMS **3 (3-0) f s**
Study of the social and cultural aspects of specific problems such as crime, divorce, race conflict, illness, poverty, housing, recreation and personality adjustment to demonstrate the basic integration of society and community life.

SOC 304 CONTEMPORARY FAMILY LIFE **3 (3-0) f s**
Basic interactions involved in courtship, marriage and family life; analysis of the influence of family life upon economic, social, political and religious actvities; cultural and technological changes affecting the family; analysis of family structure and functions.

SOC 305 RACE RELATIONS **3 (3-0) f s**
Analysis of race relationships both in the United States and throughout the world with particular emphasis on factors producing the changes taking place at the present time.

SOC 306 DELINQUENCY AND CRIME **3 (3-0) f s**
Causes and conditions leading to delinquency; delinquency as a forerunner of crime; characteristics of the offender; methods of prevention and treatment of crime.

SOC 401 HUMAN RELATIONS IN INDUSTRIAL SOCIETY **3 (3-0) f s**
Selected societies about the world contrasted with American society to demonstrate correlation between technology and general behavior patterns, both within industry and in the total social order; analysis of patterns of adjustment by the individual to the organizational framework in terms of social status, social roles, work norms and attitudes; social significance of major characteristics of contemporary industry; inter-relationship between industry and social change; contribution of industry to social progress.

SOC 402 CITY LIFE **3 (3-0) f s**
A study of the factors behind the organic growth of cities; the relationship between the physical design of cities and their social organization; detailed analysis of new developments in the serving of human needs; comparison of socio-psychological aspects of life in an urban society with those of predominantly agricultural societies; increasing integration of urban and rural living; study of demand for city and regional planning and use of administrative personnel with both technical and social backgrounds created by changing character of urban life.

SOC 411 COMMUNITY RELATIONSHIPS **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 412 INTRODUCTION TO SOCIAL WORK **3 (3-0) f s**
A course designed to acquaint students with the various types of public and private social work and with remedial and preventive programs in applied sociology, social psychiatry, health, public welfare and recreation.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

SOC 501 LEADERSHIP **3 (3-0) f s**
Prerequisites: SOC 202, 301 or equivalent
A study of leadership in various fields of American life; analysis of the various factors associated with leadership, with particular attention given to recreational, scientific and executive leadership problems.

Mr. Winston

SOC 502 SOCIETY, CULTURE, AND PERSONALITY **3 (3-0) f s**
Prerequisites: SOC 202, 301 or equivalent
Human personality from its origins in primary groups through its development in secondary contacts and its ultimate integration with social norms. Emphasis is placed upon the normal personality and the adjustment of the individual to our society and our culture. Dynamics of personality and character structure are analyzed in terms of the general culture patterns and social institutions of society.

Messer. Rawls, Winston

SOC 504 EDUCATION IN MODERN SOCIETY **3 (3-0) f s**
Prerequisites: SOC 202, 301 or equivalent
Social factors conditioning learning and formal education; the social role of the teacher in the classroom and in the community; the function of the school in social change and progress.

Mr. Johnson

SOC 505 THE SOCIOLOGY OF REHABILITATION **3 (3-0) f s**
Prerequisites: SOC 202, 301 or equivalent
The course stresses the social and cultural implications of the rehabilitation approach. Emphasis is placed upon the social and personal problems of physically and mentally handicapped persons. The interrelationships of the major social environments are considered at length in this regard. Objectives of the rehabilitation processes are analyzed in terms of the sociology of work. A major portion of the course is devoted to rehabilitation as a profession, particular attention being given to the diverse roles of specialists in this field.

Mr. Rawls

SOC 510 INDUSTRIAL SOCIOLOGY **3 (3-0) f s**
Prerequisites: SOC 202, 301 or equivalent
Industrial relations analyzed as group behavior with a complex and dynamic network of rights, obligations and rules; the social system as an interdependent part of total community life; background and functioning of industrialization studied as social and cultural phenomena; analysis of specific problems of industry.

Mr. Johnson

SOC 515, 516 RESEARCH IN APPLIED SOCIOLOGY **3 (arrange) f s**
Prerequisites: SOC 202, 301 or equivalent
Individual research problems in applied fields of sociology, such as problems of the family, population and social work; rural-urban relations; student success; American leadership.
Graduate Staff

SOILS

COURSES FOR UNDERGRADUATES

SOI 200 SOILS **4 (3-3) f s**
Prerequisite: CH 103 or 203. MIG 120 is recommended but not required
The fundamental properties of soils and their relation to proper soil management. Geological information important to an understanding of soils and agriculture is presented for a better understanding of the interrelationship which exists between soils and management.
Mr. Folks

SOI 302 SOILS AND PLANT GROWTH **3 (3-0) s**
Prerequisite: SOI 200, BO 102, PY 211
An examination of the fundamental chemical, physical and microbiological characteristics of soils as related to crop production. The chemical and mineralogical composition of soils; ion exchange, soil reaction and the solubilities of plant nutrients; transformations between organic and inorganic forms of plant nutrients; water and air relations in soils; lecture—demonstrations will be used to illustrate fundamental soil properties and to acquaint students with methods used in the study of soils.
Mr. Coleman

SOI 302 L SOILS AND PLANT GROWTH **1 (0-1)**
Prerequisites: SOI 302, CH 212 or 215
Laboratory experiments to illustrate fundamental soil chemical and physical properties and to acquaint the student with techniques used in soil studies.

SOI 341 SOIL FERTILITY AND FERTILIZERS **3 (3-0) f**
Prerequisite: SOI 200, BO 102
History of Plant Nutrition and Soil Fertility. Plant nutrition and growth as related to crop fertilization. Fertilizer materials, their manufacture, properties and usage. Fertilizer practices as related to a sound soil management program.
Mr. McCants

SOI 452 SOIL CLASSIFICATION **3 (2-3) s**
Prerequisite: SOI 200
The processes involved in the origin of soil and its properties are explained. Logical schemes of soil classification and soil management are developed based upon soil profile properties as operational criteria. The laboratories and field trips are designed to teach the student how to recognize certain soil profile properties and inferences which may be drawn from them.
Mr. Folks

SOI 461 SOIL CONSERVATION AND MANAGEMENT **3 (3-0) f**
Prerequisite: SOI 302 or permission of instructor
The history and status of erosion and fertility conditions; the economic and social aspects of soil conservation; the effects of climatic factors, vegetation (forest, sod crops, cover crops and rotations), soil properties, and other management practices on soil conservation and fertility maintenance.
Mr. Lutz

SOI 480 SENIOR SEMINAR **1 (1-0) f s**
Prerequisite: Senior standing in the School of Agriculture
A student participation course in which the student will prepare and present thorough and documented discussions of important soils topics.
Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

SOI 511 SOIL PHYSICS **4 (3-3) f**
Prerequisites: SOI 200, PY 212
Physical constitution and analyses; soil structure, soil water, soil air and soil temperature in relation to plant growth.
Mr. Lutz

SOI 521 SOIL CHEMISTRY **4 (3-1) f**
Prerequisites: SOI 341, CH 212, 532
Chemical composition and properties of soil, particularly concerning clay mineralogy, chemical processes of weathering and chemical properties of clays. The laboratory is concerned with procedures for the separation and identification of soil constituents and studies of certain fundamental properties of clay systems.
Mr. Weed

SOI 522 SOIL CHEMISTRY (Biochemical) **4 (3-1) s**
Prerequisites: SOI 341, CH 212, 532
The chemistry of ion exchange phenomena of clay minerals and organic colloids in soils. Biochemical and mathematical concepts of the dynamic equilibrium involved in ion exchange and nutrient uptake by living organisms. Laboratory consists of fundamentals and quantitative evaluation of the chemical nature and properties of soils.

Mr. Volk

SOI 532 SOIL MICROBIOLOGY **3 (3-0) f**
Prerequisites: SOI 200, BO 312
The more important microbiological processes that occur in soils; decomposition of organic materials, ammonification, nitrification and nitrogen fixation.

Mr. Bartholomew

SOI 551 SOIL MORPHOLOGY, GENESIS AND CLASSIFICATION **4 (3-3) f**
Prerequisites: SOI 200, CH 212, MIG 120
Morphology: Study of concepts of soil horizons and soil profiles and chemical, physical and mineralogical parameters useful in characterizing them. Genesis: Critical study of soil forming factors and processes. Classification: Critical evaluation of 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. Laboratory comprises field trips for field study of soil profiles representative of Great Soil Groups present in North Carolina, and a number of exercises illustrating methods of study of soil Morphology.

Mr. McCracken

SOI 570 SPECIAL PROBLEMS **Credits by arrangements**
Prerequisite: SOI 201, CH 212
Special problems in various phases of Soils. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research.

Staff

COURSES FOR GRADUATES ONLY*

SOI 611 ADVANCED SOIL PHYSICS* ** **4 (arranged)**
Prerequisites: SOI 511, MA 401, PY 202
An introduction into the usage of theoretical methods in soil physics. Lectures, literature and discussions centered around problems in the movement of soil water, soil gases and heat flow through soils.

Mr. Van Bavel

SOI 622 ADVANCED SOIL CHEMISTRY **2-4 by arrangement**
Prerequisites: SOI 521, 522
A critical examination of current ideas in Soil Chemistry and related fields. Topics will include ion exchange, ionic and molecular absorption, electrokinetics, relations between the structures of mineral and organic soil components and their chemical and physical properties.

Mr. Coleman

SOI 632 ADVANCED SOIL MICROBIOLOGY **2-4 as arranged**
Prerequisites: SOI 522, 531, CH 421, 422
A critical examination of information relating to the nature and value of microbiological processes in soil. Segments of the course will be devoted to: (1) Formation, chemical composition and biological stability of soil organic matter; (2) Biological transformations of nitrogen; (3) Function of organic matter in soil; (4) Factors influencing nitrogen fixation; and (5) Plantmicrobial relationships.

Mr. Bartholomew

SOI 642 ADVANCED SOIL FERTILITY** **3 (3-0) s**
Prerequisites: SOI 511, 521, 522
Soil conditions affecting crop growth; the chemistry of soil and plant interrelationships; theoretical and applied aspects of fertilizer usage in relation to plant nutrition.

Mr. Fitts

SOI 651 ADVANCED SOIL GENESIS AND CLASSIFICATION **2-3, by arrangement f or s**
Prerequisites: SOI 521, 551
A critical study of current theories and concepts in soil genesis and morphology; detained study of soil taxonomy. Topics include weathering and clay mineral genesis as related to soil morphology and genesis, functional analyses of soil genesis, properties of and processes responsible for soil profiles formed under various sets of soil forming factors, classification theory and logic as applied to soil classification, sturcture of soil classification schemes. Any of these topics may be emphasized at the expense of the others according to interests of students.

Mr. McCracken

TEXTILES

SOI 680 SEMINAR **1 (1-0) f s**
Prerequisite: Graduate standing in Soils
Scientific articles, progress reports in research and special problems of interest to agronomists reviewed and discussed.
A maximum of two credits is allowed toward the Master's degree, but any number toward the Doctorate.

Graduate Staff

SOI 690 RESEARCH **Credit by arrangements**

Prerequisite: Graduate standing in Soils
A maximum of six credits is allowed toward the Master's degree, but any number toward the Doctorate.

Graduate Staff

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* Students are expected to consult the instructor before registration
** Offered in 1958-59 and in alternate years.
*** Offered in 1959-60 and in alternate years.

STATISTICS

SEE EXPERIMENTAL STATISTICS

SCHOOL OF TEXTILES

COURSES FOR UNDERGRADUATES

TX 101 YARN PRINCIPLES **2 (1-2) f s**
Corequisite: MA 111
Required of freshmen in all Textile curricula
This course is an introduction to textile manufacturing. It covers briefly the processes common to yarn manufacturing, and in a broader sense the types of mechanisms common to all textile machines, calculations involving speeds, productions and twists that are associated with these mechanisms, and the theory and application of the cotton numbering system. The lecture and recitation work are supplemented by laboratory application, which covers in detail the work of the classroom.
One 1-hour lecture and one 2-hour laboratory period per week.

Staff

TX 201 YARN MANUFACTURE II **4 (3-2) f s**
Prerequisite: TX 101
Required of sophomores in Textiles
Combined lecture and laboratory instruction on the functions involved in processing textile fibers on the cotton system from the raw product to the spun yarn. Particular emphasis is given to a study of the functions of opening, cleaning, doubling, evening and drafting.
Three 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Pardue, Stuckey, Wiggins

TX 301 YARN MANUFACTURE III **4 (3-2) f s**
Prerequisites: TX 201, TX 281; PY 212
Required of juniors in Textiles
A continuation of Yarn Manufacture II on the functions of twisting and packaging of cotton rovings and yarns, with laboratory work supplementing lecture instruction. Also included is a study of textile machines as producing units—such machines as combers, roving frames, twisters and the like.
Three 1-hour lectures and one 2-hour laboratory period per week.

Mr. Porter

TX 321 TEXTILE TESTING I **3 (1-4) f**
Prerequisite: PY 212
Required of juniors in Textiles Chemistry
Physical testing and evaluation of yarns and fabrics with emphasis on techniques, instruments and methods for quality measurements of finished products; also collection and interpretation of data and reporting of results.
One 1-hour lecture and two 2-hour laboratory periods per week.

Mr. Hamby

TX 323 TEXTILE TESTING II **3 (2-2) f s**
Prerequisite: TX 281; PY 212
Required of juniors in Textiles
Quality control methods for textile processing, with emphasis on the measurement by laboratory instruments and techniques, and including a study of the mechanical and natural influences involved.
Two 1-hour lectures and one 2-hour laboratory periods per week.
Messrs. Hamby, Stuckey; Mrs. Gast

TX 401 YARN MANUFACTURE IV **4 (3-2) f s**
Prerequisite: TX 301
Required of seniors in Yarn Manufacturing and General Textiles Options
Elective for others
Refinements on yarn production, such as detailed study of carding; production levels; comber types, settings and quality aspects; modern drafting assemblies. Review of all yarn mill calculations. Production of novelty yarn, and special yarns such as voile, crepe. Manufacturing of thread yarn. Special techniques and problems; types of winders; large package production, types of travelers and rings; operation schedules. Lab project in small groups. (Piece rates.)
Three 1-hour lectures and one 2-hour laboratory period per week.
Mr. Stuckey

TX 402 MILL TECHNOLOGY **3 (3-0) s**
Prerequisite: TX 301
Required of seniors in Yarn Manufacturing and Synthetics Options
Elective for others
Mill Layout: layout of textile mill of cotton or synthetics type. Types of machines, numbers and balance of equipment. Floor layout plans and process flow, speeds, productions, help layout, power and investment.
Three 1-hour lectures per week.
Messrs. Grover, Pardue, Stuckey

TX 411 WOOL MANUFACTURE I **3 (2-2) f s**
Prerequisite: TX 301
Required of seniors in Yarn Manufacturing and General Textiles Options
Elective for others
Raw materials used in wool and worsted trades; classification, structure and characteristics of fibers, grading, sorting and mixing. Reclaimed wool and secondary raw materials. Lectures are supplemented by laboratory applications.
Two 1-hour lectures and one 2-hour laboratory period per week.
Mr. Pardue

TX 424 DEVELOPMENT PROJECT **2 (0-4) s**
Prerequisite: TX 323
Required of seniors in Quality Control Option
Studies are conducted independently on assigned problems, and seminars are held on applications and administration of testing, quality control and development. Studies and discussion of budgeting and evaluation of priority and progress. Current technical developments are discussed. Results of project to be written in form of a technical report from a control and development laboratory.
One 4-hour laboratory period per week.
Staff

TX 431 SYNTHETICS I **2 (2-0) f s**
Prerequisite: TX 281
Required of seniors in General Textiles, Weaving and Designing and Yarn Manufacturing Options
A general course including; textile processing of continuous filament synthetic yarns in the yarn producing plants; preparation of yarns for weaving and knitting including crepe, voile and hosiery yarns; the application of synthetic yarns for use as industrial yarns and fabrics; also, calculation involving the denier system and production calculations.
Two 1-hour lectures per week.
Mr. Wiggins

TX 433 SYNTHETICS II **4 (3-2) f**
Prerequisite: TX 281 and Senior standing
Required of seniors in Synthetics Option
An advanced study of the physical problems and the relations of physical properties to the processing characteristics and end product performances of the synthetic fibers. A study of the influence of twist on physical properties of filament yarns; comprehensive studies of the processing of sized and unsized filament yarns as encountered in the throwing industry and in preparation for knitting and weaving. A study of the industrial uses of synthetic fibers and the requirements of such uses.
Three 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Hamby, Wiggins

TEXTILES

TX 435 SYNTHETIC FIBER PROCESSING **4 (3-2) f s**
Prerequisite: TX 301
Required of seniors in Yarn Manufacturing and Synthetic Options
Elective for others
Studies of the contributions of individual fibers to the entire blend covering both the man-made as well as natural fibers. Processing of man-made fibers into spun yarn and fabric, particularly on the cotton system. The processing of man-made fibers by new methods, such as by direct spinning and the Pacific Converter. Studies of the modification of machines for processing synthetic fibers alone or in blend with other fibers.
Three 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Grover, Hamby, Pardue

KNITTING TECHNOLOGY

TX 241 KNITTING I **3 (2-2) f s**
Required of sophomores in Textiles
Selection and preparation of knitting yarns, knitting mechanisms, structure of selected types of spring and latch needle fabrics; operation and adjustment of the basic types of knitting machines.
Two 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Lewis, Middleton

TX 341 HOSIERY MANUFACTURE **2 (2-0) f s**
Prerequisite: TX 241
Required of juniors in Textiles
A study of advanced types of circular knitting machines and the problems involved in the manufacture of fine hosiery. Hosiery design and analysis.
Two 1-hour lectures per week.
Mr. Middleton

TX 343 KNITTED FABRIC DESIGN AND ANALYSIS **2 (0-4) f**
Prerequisite: TX 341
Required of seniors in Knitting Technology Option
Elective for others
Stitch formation for the more intricate knitted fabrics; control mechanisms for pattern work; designing methods; analysis of fabrics for reproduction and costing; color in knit goods.
Two 2-hour laboratory periods per week.
Mr. Lewis

TX 441 FLAT KNITTING **3 (2-2) f**
Prerequisite: TX 341
Required of seniors in Knitting Technology Option
Elective for others
A study of the leading types of flat knitting machines including warp knitting machines, design possibilities and fabric adaptability.
Two 1-hour lectures and one 2-hour laboratory period per week.
Mr. Shinn

TX 443 KNITTING MECHANICS **3 (2-2) f**
Prerequisite: TX 341
Required of seniors in Knitting Technology Option
Elective for others
Mathematics and mechanics of flat and rib knitting. Interrelation of yarn number, yarn diameter, gauge, cut, stitch, length, fabric structure and weight; proportions of yarns in multiple-thread work; production problems, etc.
Two 1-hour lectures and one 2-hour laboratory period per week.
Mr. Shinn

TX 444 GARMENT MANUFACTURE **3 (2-2) s**
Prerequisite: TX 341
Required of seniors in Knitting Technology Option
Elective for others
A study of circular latch needle and spring needle machines for knit fabric production styling, cutting and seaming of the basic garment types for underwear and outerwear; standard seam types; high-speed sewing machines.
Two 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Lewis, Shinn

TX 445 FULL-FASHIONED HOSIERY MANUFACTURE **2 (2-0) s**

TX 447, 448 KNITTING LABORATORY II **2 (0-4) f s**
Prerequisite: TX 341
Required of seniors in Knitting Technology Option
Elective for others
Mechanics of the full-fashioned hosiery machine including practical training in its adjustment and operation. Attention is given to yarn preparation, knitting, inspection, finishing and packaging hosiery.
One 4-hour laboratory period per week each semester. Two 1-hour lectures per week in spring semester.
Mr. Shinn

TX 449 TRICOT KNITTING **3 (2-2) s**
Prerequisite: TX 341
Required of seniors in Knitting Technology Option
Elective for others
A study of basic types of tricot knitting machines with emphasis on mechanisms and fabrics. Attention is given to warp preparation methods applicable to the tricot machine, the characteristics of yarn made from natural and synthetic fibers as they affect processing into warp knitted fabrics, machine settings for proper qualities and ratios; economics of warp knitting, and end uses. Attention is given to fabric design and analysis.
Two 1-hour lectures and one 2-hour laboratory period per week.
Mr. Shinn

FABRIC DEVELOPMENT

TX 151 FABRIC PRINCIPLES **2 (1-2) f s**
Required of freshmen in all Textile curricula
An introduction to the study of fabric development and construction. The methods of preparing yarn for weaving, the weaving of fabrics, and the calculations required to produce a fabric are included. Lectures are supplemented by laboratory exercises in operation of the machinery.
One 1-hour lecture and one 2- hour laboratory period per week.
Mr. Whittier and Staff

TX 251 CAM WEAVING **3 (1-4) f s**
Prerequisite: TX 151
Required of sophomores in Textiles
A study of the functions, operation and interrelationship of cam loom mechanisms and a study of preparing yarns for weaving, including systems of creeling, beaming, slashing, drawing-in, tying-in and filling preparation.
One 1-hour lecture and two 2-hour laboratory periods per week.
Messrs. Berry, Klibbe, Moser

TX 261 FABRIC STRUCTURE **3 (2-2) f s**
Prerequisite: TX 151
Required of sophomores in Textiles and Textile Chemistry
A study of the fundamental principles of fabric construction and weave formation of selected staple fabrics. Laboratory instruction is given in physical analysis and design techniques essential to the development of technical specifications for the production of woven fabrics.
Two 1-hour lectures and one 2-hour laboratory.
Messrs. Berry, Gaither, Klibbe

TX 271 UPHOLSTERY FABRICS **2 (2-0) f**
Required of sophomores in Furniture Manufacturing
A study of the basic principles of textile manufacturing and structure of woven fabrics, identification of classic decorative fabrics used for upholstered furniture coverings, with emphasis on nomenclature and physical properties and textile trade customs.
Two 1-hour lectures.
Messrs. Gaither, Whittier

TX 351 DOBBY WEAVING **3 (2-2) f s**
Prerequisite: TX 251; PY 212
Required of juniors in Textiles
A continuation of instruction in the operational functions of loom mechanisms, involving certain motions not covered in cam weaving. This includes a description of different type looms, drop box motions, single and double index dobbies, and transfer motions. The causes and remedies of fabric defects, the building of chains, the proper settings, and the operation of dobby and drop box looms are taught by practical application in the laboratory classes.
Two 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Berry, Gaither, Moser

TX 361 DOBBY DESIGN **3 (1-4) f s**
Prerequisite: TX 261
Required of juniors in Textiles
A study of classic dobby weave formations such as spot designs, fancy twills, honeycomb, extra warp and filling figure; together with the pattern layout, design system and analysis of the physical structure of select staple and styled dobby woven fabrics.
One 1-hour lecture and two 2-hour laboratory periods per week.
Messrs. Gaither, Klibbe, Moser

TX 451 WEAVING LABORATORY **1 (0-2) f s**
Prerequisite: TX 351
Required of seniors in General Textiles and Weaving and Designing Options
Elective for others
Operation and fixing of dobby, pick and pick and jacquard looms; preparation of warps to weave rayon, wool and fine cotton fabrics; building of box, dobby and multiplier chains; and project involving the preparation and weaving of an approved fabric design.
One 2-hour laboratory period per week.
Messrs. Berry, Moser

TEXTILES

TX 452 WEAVING TECHNOLOGY **2 (0-4) s**
Prerequisite: TX 451
Required of seniors in Weaving and Designing Option
Elective for others
Continuation of TX 451 with special emphasis upon making original designs for dobby fabrics, preparing the warps and weaving the fabrics.
Two 2-hour laboratory periods per week.

Messrs. Berry, Moser

TX 461 DESIGN IV **3 (2-2) f**
Prerequisites: TX 361
Required of seniors in General Textiles and Weaving and Designing Options
Elective for others
A continuation of DOBBY DESIGN TX 361, with emphasis on the design, construction and weave of specialized fabrics. A review of designing principles and their relation to double woven cloths, corduroys, lenos, jacquards, etc. is included in the lectures and in the laboratory period, which is devoted to analysis.
Two 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Berry, Gaither, Moser

TX 471 DEVELOPMENT OF WOVEN DESIGN **2 (2-0) f s**
Prerequisite: TX 361
Elective
A study of the factors which determine the quality, style and color of fabrics, including the design specifications and production calculations necessary for the translation of design ideas into woven textiles.
Two 1-hour lectures per week.

Mr. Gaither

TX 472 FABRIC ANALYTICS **2 (2-0) f s**
Prerequisite: TX 361
Required of seniors in General Textiles and Weaving and Designing Options
Elective for others
A supplementary course in fabric structure to demonstrate how fabrics can be designed to meet specific requirements for utility and aesthetic value. The methods and calculations involved in predetermining weight, cost, texture, strength, extensibility, thickness and other important properties of fabrics are explained, using actual cases of consumer problems as examples.

Mr. Whittier

TX 473 FABRIC CHARACTERISTICS **2 (1-2) f s**
Prerequisite: TX 361
Elective
A study of the identification, classification and utilization of woven fabrics and how these are affected by various properties such as geometry, weave and finish. Actual inspection of a wide range of fabrics with emphasis on a study of defects and their influence on quality will be included in the laboratory work.
One 1-hour lecture and one 2-hour laboratory period per week.

Mr. Whittier

TX 476 SYNTHETICS III **3 (2-2) s**
Prerequisites: TX 351, 361
Required of seniors in Synthetics Option
Advanced study of the development and construction of fabrics made with synthetic yarns. The course includes lectures on the special problems encountered in the design, warp and filling preparation and weaving of fabrics made with filament yarns. The methods used by industry to overcome these difficulties are demonstrated in the laboratory sessions.
Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Moser

TEXTILE CHEMISTRY

TC 201 TEXTILE CHEMISTRY I **2 (2-0) f s**
Prerequisite: CH 103
Required of sophomores in Textiles
A comprehensive course designed to familiarize the student with the chemical properties of all natural and synthetic fibers, and with their expected behavior under the various conditions to which they may be exposed. A brief survey of those parts of organic chemistry applicable to textile materials is included.

Mr. Rutherford

TC 301, 302 TEXTILE CHEMISTRY II **3 (2-2) f s**
Prerequisite: TC 201
Required of seniors in Textiles
A comprehensive course covering: a brief outline of the methods of scouring, bleaching, dyeing, printing and finishing textile materials; a study of the machinery involved in the wet handling of textiles.
Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Hayes

TC 303, 304 TEXTILE CHEMISTRY III **4 (2-4) f s**
Prerequisite: Concurrent enrollment in CH 421, 422
Required of juniors in Textile Chemistry
A study of the action of chemicals on fibers; methods and chemistry of scouring, bleaching and mercerization; preparation of typical dyestuffs and their application to fibers.
Two 1-hour lectures and one 4-hour laboratory period per week.
Mr. Hayes

TC 403, 404 TEXTILE CHEMISTRY IV **4 (2-4) f s**
Prerequisite: TC 304
Required of seniors in Textile Chemistry
A continuation of TC 303 and 304 with special emphasis on modern dyeing methods. Laboratory exercises and use of pilot and mill scale equipment of many types in dyeing all important fibers and fiber mixtures. Selected topics of importance to the textile chemist with special attention to current technological advances in the field. Visits to mills selected to cover a wide variety of processing techniques.
Two 1-hour lectures and one 4-hour laboratory period per week.
Mr. Campbell

TC 411 TEXTILE CHEMICAL ANALYSIS I **3 (1-4) arrange**
Prerequisite: CH 211
Elective for students in Textile Chemistry
Analysis and evaluation of textile chemicals and related materials such as water, soap, wetting agents, synthetic detergents, bleaching and stripping agents and finishing compounds. Identification and quantitative determination of materials employed in several categories of textile wet processing such as sizes, surface-active agents, dyestuffs and finishes.
One 1-hour lecture and one 4-hour laboratory period per week.
Messrs. Campbell, Rutherford

TC 412 TEXTILE CHEMICAL ANALYSIS II **3 (1-4) s**
Prerequisites: CH 211 and TC 304
Elective for students in Textile Chemistry
Analysis of textile materials involving specialized instruments and techniques such as spectrophotometry, pH measurements, electrometric titration, viscometry, etc.
One 1-hour lecture and two 2-hour laboratory periods per week.
Messrs. Campbell, Rutherford

TC 421 FABRIC FINISHING I **2 (2-0) f s**
Prerequisite: TC 201
Required of seniors in Synthetics Option. Elective for others, except students in Textile Chemistry
A general course in fabric finishing designed for students not majoring in Textile Chemistry. Emphasis placed on finishes used on garment-type fabrics, including stabilization finishes, water repellency, crease resistance, moth and mildew proofing, fire-proofing, etc. Emphasis on chemistry of finishes varied to fit requirements of students.
Two 1-hour lectures per week.
Mr. Hayes

TC 423 FABRIC FINISHING II **3 (1-4) f**
Prerequisite: TC 304
Required of seniors in Textile Chemistry
A study of the compounds used in the finishing of fabrics, and of the methods used in laboratory development and plant application of finishing compounds. Studies of the methods of evaluation of finishes are included in the laboratory work.
One 1-hour lecture and one 4-hour laboratory period per week.
Mr. Rutherford

TC 431 TEXTILE PRINTING **3 (1-4) s**
Prerequisite: TC 304
Required of students in Textile Chemistry
Fundamentals of textile printing with major emphasis on modern roller printing methods; design of printing machines, preparation of cloth for printing, formulation and properties of printing pastes, application techniques for all important types of dyestuffs, styles of printing, and aging and aftertreating procedures.
One 1-hour lecture and one 4-hour laboratory period per week.
Mr. Campbell

GENERAL TEXTILE COURSES

TX 281 FIBER QUALITY **3 (2-2) f s**
Required of sophomores in Textiles
History, development, production, ginning and handling of cotton. World crops; marketing methods; classification; relation of grade and staple to the value of cotton. Measurement of the physical properties of cotton fibers and their relation to spinning quality; relation of grade and staple to waste, spinning behavior and yarn quality. Selection of cotton for different types of yarns and fabrics.
An introduction to synthetic fiber knowledge, including the history, development, and classification of all synthetic fibers. A study of the manufacturing processes of synthetic yarns. A description of the chemical and physical properties of the fibers and yarns and how these affect the selection of synthetic yarns and fabrics by consumers.
Two 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Hamby, Stuckey, Wiggins

TEXTILES

TX 284 TEXTILE PROCESSING **3 (2-2) s**
Prerequisites: TX 101, 151
Required of sophomores in Textile Chemistry
A general textile manufacturing course covering the production of yarns and fabrics. The fundamentals of yarn manufacture, including opening, picking, cleaning, carding and spinning are covered. Special emphasis is put on creeling, beaming and slashing of warps for weaving, and the preparation of warps for knitting. Fundamental principles of textile design, weaving and knitting are covered.
Two 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Smith, Woodbury

TX 425 TEXTILE MICROSCOPY **1 (0-2) f s**
Prerequisite: TX 481
Required of all Textile and Textile Chemistry students
Experiments, lectures and demonstrations in application of microscopy to textiles. Experiments include fiber study by both longitudinal and cross-sectional section, cotton maturity, starch studies, micrometry of fibers and others. Fundamentals of porarizing, phase contrasts and electron microscopes are covered. Demonstration of euscope, projection microscope, photomicrographic cameras and other devies.
One 2-hour laboratory period per week.
Messrs. King, Stuckey

TX 483 TEXTILE COST METHODS **2 (2-0 f s**
Prerequisites: TX 301, 361
Required of seniors in Textiles exept those in Management Option
A survey of cost methods applicable to textile mills with emphasis on calculations, the preparation of cost reports, and their use in cost control.
Two 1-hour lectures per week.
Messrs. Middleton, Shinn

TX 484 MILL ORGANIZATION **3 (3-0) s**
Prerequisites: TX 301 and Senior standing
Required of seniors in Textiles
Studies of organizations of textile mills from personnel as well as functional viewpoints and of the planning and scheduling of manufacturing contracts through opening and weaving mills. Analysis of manufacturing organizations based on processes and equipment.
Three 1-hour lectures per week.
Mr. Grover

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

FIBER AND YARN TECHNOLOGY

TX 501 YARN TECHNOLOGY SEMINAR **2 (2-0) s**
Prerequisite: TX 401 and consent of instructor
Elective
Lecture and discussion periods are designed for students who are particularly interested in the yarn manufacturing aspects of the textile industry. Subject matter will include such various aspects as training methods, safety programs, modern mill design, specialized techniques in setting rates, employee relations and developments that arise from technical meetings.
Two 1-hour lectures per week.
Messrs. Grover, Hamby

TX 521 TESTING AND QUALITY CONTROL **4 (2-4) f**
Prerequisite: TX 323 or TX 321
Required of students in Quality Control Option. Elective for others
Testing of natural and man-made fibers and of yarns and fabrics, with emphasis on advanced testing techniques. Consideration of quality control programs, including "defect preventive" methods, pin-pointing of troubles and the relationship between the quality control department and operating divisions. Technical report writing, literature research and study of military specifications and U. S. Government standards as CCC-T-191b. Attendance at technical meetings such as the Fiber Society, American Society for Testing Materials, American Society for Quality Control is encouraged.
Two 1-hour lectures and one 4-hour laboratory period per week.
Messrs. Hamby, Stuckey

TX 522 TEXTILE TESTING III **4 (2-4) s**
Prerequisite: TX 521, or graduate standing with approval of instructor
Required of students in Quality Control Option. Elective for others
Mechanics of textile fabrics, with emphasis on the application of engineering criteria to laboratory evaluation of natural and man-made fibrous materials, stress-strain relationships, modifications due to impact, torsional properties, thermoplastic material degradation, permeability to gases and liquids, theory of induced wear with influence of abrasion. Influence on fabric properties resulting from blending of fibers, and modification of properties by varying fiber distribution. Specialized techniques of controlling attributes and variables of fabric quality.
Two 1-hour lectures and one 4-hour laboratory period per week.
Messrs. Hamby, Stuckey

TX 525 ADVANCED TEXTILE MICROSCOPY **2 (arranged) f s**
Prerequisite: TX 425
Elective
Experiments, lectures and demonstrations in more advanced techniques of textile microscopy. Detailed studies of structures of fibers covered in lecture series, supplemented by experiments on lecture topics. Detailed study of all types of microscopes and their uses in textiles. Preparation of slides for photography. Uses of photomicro-graphic equipment.
Lectures and laboratories arranged.

Mr. Stuckey

TX 551 COMPLEX WOVEN TEXTILE STRUCTURES **2 (2-0) s**
Prerequisite: TX 451, TX 461
Elective
Consideration of machine-design factors and operational problems and factors peculiar to the manufacture of selected complex fabrics. Unique economic problems of fabric production.
Two 1-hour lectures per week.

Mr. Berry

TX 561 SPECIAL WEAVE FORMATIONS **2 (2-0) s**
Prerequisite: TX 461
Required of seniors in Weaving and Designing Option. Elective for others
A detailed study of the creation of weave formations which require specially designed let-off motions, take-up motions, doup heddles, swinging reeds, indicator chains, etc. Such fabrics as terry cloth, marquisette, leno stripes, seersuckers and mission net are included.
Two 1-hour lectures per week.

Mr. Berry

TX 562 JACQUARD DESIGN AND WEAVING **3 (2-2) s**
Prerequisite: TX 361
Required of seniors in Weaving and Designing Option. Elective for others
The application of punched card techniques to the design and manufacture of certain fabrics having intricate decorative patterns and special surface charateristics.
Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Berry

TEXTILE CHEMISTRY

TC 501 SEMINAR IN TEXTILE CHEMISTRY **2 (arranged) s**
Prerequisite: TC 403
Elective for Textile Chemistry students
The course is designed to familiarize the student with the principal sources of textile chemical literature and to emphasize the importance of keeping abreast of developments in the field of textile chemistry. Particular attention is paid to the fundamentals of technical writing. Reports.
Lectures arranged.

Mr. Campbell, Staff

TC 511, 512 CHEMISTRY OF FIBERS **2 (2-0) f s**
Prerequisite: CH 422
Required of seniors in Textile Chemistry
A lecture course emphasizing: the theory of fiber structure; the relationship between the chemical structure and physical properties of natural and synthetic fibers; the nature of the chemical reactions which produce degradation of fibers; the production of synthetic fibers.
Two 1-hour lectures per week.

Mr. Rutherford

TC 521 TEXTILE CHEMICAL ANALYSIS III **3 (arranged) f s**
Prerequisite: TC 421, or permission of instructor
Elective for all Textile students except those majoring in Textile Chemistry
The work includes the chemical identification of fibers, the qualitative and quantitative analysis of fiber blends by chemical means and the evaluation techniques for dyed and finished materials.

Messrs. Campbell, Rutherford

GENERAL TEXTILE COURSE

TX 581 INSTRUMENTATION AND CONTROL **3 (2-2) f s**
Prerequisite: PY 212
Required of all seniors in Textiles and Textile Chemistry
A lecture series with coordinated laboratory exercises designed to familiarize the student with the theory and application of instruments and control apparatus that he will find in the modern textile plant.
The studies cover the measurement and control of temperature, humidity, regain, chemical processes, physical finishing processes, time and temperature cycles, yarn and cloth tension, speed and fluid pressure.
Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Asbill

TEXTILES

COURSES FOR GRADUATES ONLY

TX 601, 602 YARN MANUFACTURE **3 f s**
Prerequisite: TX 401 or equivalent
A study of breaking strength and related properties of cotton yarns made under various atmospheric conditions; comparison of yarns produced from long and short-staple cotton with regular and special carding processes; efficiency of various roller covering methods of preparation; comparison of regular and long-draft spinning.

Messrs. Grover, Hamby

TX 621 TEXTILE TESTING IV **2 f s**
Prerequisite: TX 522 or equivalent
Design of textile laboratories, including conditioning equipment and instruments required for specific needs; performance of tests and analysis of data on industrial problems; specialized physical tests; inter-laboratory tests and analysis; study of A.S.T.M. specifications and work on task groups for the A.S.T.M. Society.

Mr. Hamby

TX 631 SYNTHETICS IV **2 s**
Prerequisite: TX 433 or equivalent
Setting up of an assigned project on problems peculiar to the processing of continuous filament yarns, particularly in the initial preparatory stages of processing, and including sizing, twisting, winding and associated problems.

Messrs. Grover, Hamby

TX 641, 642 ADVANCED KNITTING SYSTEMS AND MECHANISMS **3 f s**
Prerequisite: TX 441 or equivalent
A critical study of inventions which have contributed to the development of the modern knitting industry; knitting needles and their adaption for specific uses; means for mounting them for individual and en masse operation; construction and functioning of cooperating elements including sliders, jacks, sinkers, dividers, pressing elements, narrowing and tensioning and draw-off motions, regulating mechanisms, timing and control chains and cams. Use will be made of patent literature such as U. S. Patents 2,413,601 and 2,431,160, Bitzer, which represent important developments in the full-fashioned hosiery industry. Three 1-hour lectures per week.

Mr. Shinn

TX 643, 644 KNITTING RESEARCH **3 f s**
Prerequisites: Graduate standing and 8 credits in Knitting
Problems of specific interest to the knitting industry will be assigned for study and investigation. The use of experimental methods will be emphasized. Attention will be given to the preparation of reports for publication.

Graduate Staff

TX 651, 652 FABRIC DEVELOPMENT AND CONSTRUCTION **3 f s**
Prerequisite: B.S. degree in Textiles (Weaving and Designing Option) or equivalent
Application of advanced technology to the development and construction of woven fabrics.

Mr. Whittier

TX 681, 682 TEXTILE RESEARCH **Credits by arrangement f s**
Problems of specific interest to the textile industry will be assigned for study and investigation. The use of experimental methods will be emphasized. Attention will be given to the preparation of reports for publication. The master's thesis may be based upon the data obtained.

Graduate Staff

TX 683, 684 SEMINAR **1 f s**
Discussion of scientific articles of interest to textile industry; review and discussion of student papers and research problems.

Graduate Staff

TC 605 PHYSICAL CHEMISTRY OF DYEING **3 (3-0) f**
Prerequisites: CH 422, PY 212, MA 212 or graduate standing
Dyeing is treated as a physio-chemical process emphasizing equilibria, kinetics and practical aspects of research into dyeing processes.

Mr. Cates

TC 606 CHEMICAL OF FIBER-FORMING HIGH POLYMERIC SYSTEMS **3 (3-0) s**
Prerequisites: CH 422, PY 212, MA 212 or graduate study
The course will embody studies of the mechanism and kinetics of polymerization, the properties and behavior of high polymer solutions, the mechanical behavior of natural and synthetic fibrous material as related to the molecular structures.

Mr. Cates

ZOOLOGY

COURSES FOR UNDERGRADUATES

ZO 101 GENERAL ZOOLOGY **3 (2-2) f s**
Animals with special reference to the morphology and physiology of vertebrates, including intensive laboratory study of the mammal with lecture and laboratory work closely integrated and applied to human life.

Staff

ZO 102 GENERAL ZOOLOGY **3 (2-2) f s**
Animals with special reference to economic and ecological consideration designed to give the student a general understanding of animal life and its importance in human affairs.

Staff

ZO 212 HUMAN ANATOMY **3 (2-2) f**
Prerequisite: ZO 101
A study of human anatomy with major emphasis on the structure and function of the muscular, skeletal, circulatory and nervous systems. Required of majors in recreation.

Mr. Miller

ZO 213 HUMAN PHYSIOLOGY **3 (3-0) s**
Prerequisite: ZO 101
An elementary survey of human physiology. The central theme is the changes in the human body accompanying increased physical activity. The nature and mechanisms of these changes.

Mr. Miller

ZO 223 COMPARATIVE ANATOMY **4 (2-4) f**
Prerequisites: ZO 101, 102
A comparative morphology of vertebrates demonstrating the interrelationships of the organ systems of the various groups.

Mr. Harkema

ZO 252 ORNITHOLOGY **3 (2-3) s**
Prerequisite: ZO 101
The biology, natural history, and classification of North American birds, with special reference to those of North Carolina and the eastern United States. Field trips for the study and identification of local forms.

Mr. Quay

ZO 301 ANIMAL PHYSIOLOGY **3 (2-3) f s**
Prerequisites: ZO 101; PY 211; CH 101 or 201, and 203
Physiology of vertebrates with particular reference to man and the lower animals.

Mr. Santolucito

ZO 312 PRINCIPLES OF GAME MANAGEMENT **3 (3-0) f**
Prerequisite: ZO 102; Elective for juniors and seniors not majoring in Wildlife
This course is intended to provide the student with a basic understanding of the major principles of wildlife management. It is designed especially for those individuals who anticipate entering the fields of agriculture, forestry, agricultural extension or rural and industrial recreation.

Mr. Barkalow

ZO 315 ANIMAL PARASITOLOGY **3 (2-3) s**
Prerequisites: ZO 101, 102
This course is designed to give students a knowledge and appreciation of the parasitic habit. The biology, life history, pathology and control of the common parasites of domestic animals and poultry are covered.

Mr. Harkema

ZO 321 WILDLIFE AND NATURAL RESOURCE CONSERVATION **3 (3-0) s**
Prerequisite: Sophomore standing in any school
The importance of natural resources to man and the part they play in national and international affairs; the principles which underlie their conservation and the impact of over-exploitation on primitive and civilized societies. Emphasis is placed on the renewable resources, particularly wildlife.

Mr. Barkalow

ZO 332 FUR RESOURCES **3 (1-4) f**
Prerequisite: ZO 101
Life history and management of the important fur-bearing animals; skinning, drying, marketing pelts, fur farming.

Mr. Barkalow

ZO 452* ANIMAL MICROTECHNIQUE **3 (1-5) s**
Prerequisites: ZO 101, 102, and CH 203
The theory and practice of preparing temporary and permanent histological mounts for microscopic study.

Mr. Harkema

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ZO 501 ADVANCED ORNITHOLOGY** **3 (2-3) f**
Prerequisite: ZO 252, and approval of the instructor
Upland game birds, rails and waterfowl—life histories, taxonomic relations, distribution, habitat and territory, display and behavior, instinct and intelligence food habits, census methods, populations and factors affecting abundance, management problems and procedures, recent investigations, current literature.

Mr. Quay

ZO 513* ADVANCED ANIMAL PHYSIOLOGY I** **3 (3-0) f**
Prerequisite: ZO 301
Fundamentals of animal physiology from an advanced point of view. Lectures, discussions, outside reading, written and oral reports. Topics in the field of animal physiology will be selected for vigorous and detailed consideration in lectures and collateral reading. Each student will, in addition, prepare a term report, and his work will be supervised and evaluated during the preparation as well as at the end of the report. Selection of a few topics for study will be determined by the interests of the students and by their needs as may be expressed by the supervisor of their major work.

Mr. Santolucito

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* Offered in even years. Will be offered Spring 1960.
** Offered in odd years. Will be offered in Fall 1959.
*** Offered in even years. Will be offered in Fall 1960.

ZO 521 FISHERY BIOLOGY **3 (1-6) f**
Prerequisite: ZO 101, 102, and approval of the instructor
Lectures, discussions, reports, field trips and laboratories. Methods and principles of fish management. Qualitative and quantitative studies of the various factors influencing the growth and abundance of game fishes. Life history studies of freshwater and marine sport fishes. Theories of fishery science. Application of biometrical methods.

Mr. Hassler

ZO 522 ANIMAL ECOLOGY **3 (3-0) s**
Prerequisites: ZO 101, 102
The general principles of the interrelations between animals and their environments —land, fresh water, marine.

Mr. Quay

ZO 532 (GN 532)* BIOLOGICAL EFFECTS OF RADIATIONS **3 (3-0) s**
Prerequisites: ZO 101, and approval of the instructor
Recommended Correlatives: GN 411, ZO 301, and BO 421
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.

Mr. Grosch

ZO 541 COLD-BLOODED VERTEBRATES (ICHTHYOLOGY)** **3 (1-4) s**
Prerequisites: ZO 101 and 102
The classification and ecology of selected groups of fishes. Lectures, laboratories and field trips dealing with the systematic positions, life histories, interrelationships and distribution of the particular groups of fishes selected in accordance with the needs and interests of the class.

Mr. Brandt

ZO 542* COLD-BLOODED VERTEBRATES (HERPETOLOGY) **3 (1-4) s**
Prerequisites: ZO 101 and 102
The classification and ecology of selected groups of amphibians and reptiles. Lectures, laboratories and field trips dealing with the systematic positions, life histories, interrelationships and distribution of the particular groups of amphibians and reptiles selected in accordance with the needs and interests of the class.

Mr. Brandt

ZO 544 MAMMALOGY **3 (1-4) f**
Prerequisites: ZO 101, 102 and approval of the instructor
The classification and ecology of the major groups of mammals with particular emphasis on the orders native to the Southeastern United States.

Mr. Barkalow

ZO 545* HISTOLOGY** **4 (2-4) f**
Prerequisites: ZO 101, 102
The microscopic anatomy of animal tissues.
Mr. Harkema

ZO 551, 552 WILDLIFE MANAGEMENT **3 (2-3) f s**
Prerequisites: ZO 252 and BO 441, and approval of the instructor
The basic principles of wildlife management and their application are studied in the field and laboratory. The course is designed primarily for those seniors majoring in the field of wildlife management.
Mr. Barkalow

ZO 561 ANIMAL EMBRYOLOGY** **4 (2-4) f**
Prerequisites: ZO 101, 102
The study of fundamental principles which apply in the achievement of complex animal structure, including both invertebrate and vertebrate materials. Correlative laboratory study to provide training in the basic disciplines and techniques. This course is intended for advanced students in entomology, animal industry, poultry science and zoology.
Mr. Harkema

ZO 571 ADVANCED WILDLIFE MANAGEMENT, SPECIAL STUDIES **Credits by Arrangement**
Prerequisites: ZO 551 or 312, and approval of the instructor
A directed individual investigation of a particular problem, accompanied by an advanced survey of pertinent literature. A maximum of three credits allowed toward the bachelor's degree, four toward the master's degree and six toward the doctorate.
Graduate Staff

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* Offered in even years. Will be offered Spring 1960.
** Offered in odd years. Will be offered Spring 1959.
*** Offered in even years. Will be offered Fall 1958.

ZO 581 FOOD HABITS PROBLEMS **3 (0-9) f s**
Prerequisite: ZO 102, BO 102
Selected problems dealing with the foods and feeding habits of one species of wild animal or a group of similar animals.
Graduate Staff

ZO 591* PARASITOLOGY I **4 (2-4) f**
Prerequisites: ZO 101, 102, and 223
The study of the morphology, biology and control of the parasitic protozoa and helminths of man, domestic and wild animals.
Mr. Harkema

ZO 592 (ENT 582) PARASITOLOGY II MEDICAL ENTOMOLOGY **3 (2-3) s**
Prerequisite: ENT 301
A study of the morphology, biology and control of the parasitic arthropods of man, domestic and wild animals.
Mr. Harkema

COURSES FOR GRADUATES ONLY

ZO 603 ADVANCED PARASITOLOGY **3 (2-3) s**
Prerequisites: ZO 591, 592
The study of the theoretical and practical aspects of parasitism; taxonomy, physiology and immunology of animal parasites.
Mr. Harkema

ZO 611 ANIMAL ECOLOGY, SPECIAL STUDIES **Credits by Arrangement**
Prerequisites: ZO 522, and approval of the instructor
Directed individual investigation of a particular problem, accompanied by an advanced survey of literature. A maximum of three credits allowed toward the master's degree and six toward the doctorate.
Graduate Staff

ZO 614 ADVANCED ANIMAL PHYSIOLOGY II **3 (3-0) f**
Prerequisite: ZO 301, and approval of the instructor
Selected fundamental principles in physiology will be studied and interpreted for their relation to the vertebrates. Lectures and critical reports to promote acquaintance with general literature and recent advances. Lectures, discussions, written and oral reports.
Mr. Santolurito

ZOOLOGY

ZO 622 SEMINAR **1 (1-0) f s**
The presentation and defense of current literature papers dealing either with the findings of original research or with fundamental biological concepts.

Graduate Staff

ZO 627 ZOOGEOGRAPHY** **3 (3-0) f s**
Prerequisite: ZO 522, and approval of the instructor
The geographic distribution of animals—land, fresh-water, marine.

Mr. Quay

ZO 641 RESEARCH IN ZOOLOGY **Credits by Arrangement**
Prerequisites: Twelve semester credits in Zoology, and approval of the instructor
Problems in development, life history, morphology, physiology, ecology, game management, taxonomy or parasitology. A maximum of six credits is allowed toward the master's degree but any number toward the doctorate.

Graduate Staff

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* Offered in odd years. Will be given Fall 1959.
** Offered in even years. Will be given Fall 1958.

We develop new ideas and techniques. But our mission is more than that. We, also, develop men who convert the techniques into finer products and healthier crops—for North Carolina State College is an investment in the economic future of North Carolina.

John William Harrelson
Chancellor, 1934-1953



← HOLLADAY HALL

V. ADMINISTRATION AND FACULTY OF N. C. STATE

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THE ALUMNI ASSOCIATION — — — — — — — — —

H. W. Taylor, *Director of Alumni Affairs*

OBJECTIVES

The purposes of the Alumni Association are: to promote the growth, progress, and general welfare of State College; to foster among its former students a sentiment of regard for one another and continuing attachment to their Alma Mater; and to interest prospective students in attending State College.

MEMBERSHIP ACTIVITIES

Active membership is available to all former students, regardless of length of stay at the college; members of the faculty, administrative staff, Agricultural Extension Service, Agricultural Experiment Station, teachers of agriculture in North Carolina high schools; and other persons who have successfully completed a short course at North Carolina State College and received a certificate therefor.

Honorary membership consists of such distinguished persons as are duly elected to honorary membership in the Association. The Association meets annually during Alumni Week. Class reunions (scheduled so that each class has a reunion every five years after graduation) are also held each year in connection with Alumni Week. Officers of the Association are elected by the active members each year through the medium of a mail ballot. Local State College clubs are organized in most of the counties in North Carolina and in a number of cities in other states.

ALUMNI FUND

This fund was established by the Alumni Association at State College in 1952 to replace the old dues paying program and provide a means through which the alumni may contribute to the advancement of the College. Each alumnus is invited to make an annual contribution.

STATE COLLEGE NEWS

State College News is published every month in the year by the Alumni Association and sent to contributors to the Alumni Fund. The purpose of the magazine is to keep Association members in touch with the College and with each other. It carries news and pictures of former and present students and of the college.

THE ALUMNI OFFICE

Records of both graduates and nongraduates are kept by the Alumni Office. The master file includes information on all former students; other files are arranged geographically and by classes. Biographical files are also kept.

Serving as a medium of communication between alumni and the College, the Alumni Office, located in the Old Infirmary Building, is official headquarters for alumni when they visit the campus.

COLLEGE FOUNDATIONS — — — — — — — — —

L. L. Ray, *Director*

There are eight foundations organized and incorporated under the laws of North Carolina which promote and support various programs of State College.

THE NORTH CAROLINA STATE COLLEGE FOUNDATION, INC.

was organized on December 11, 1942 to foster and promote the general welfare of North Carolina State College and to receive and administer gifts and donations for such purposes. The Board of Directors is composed of Alumni of State College and members of the Board of Trustees of the University of North Carolina.

THE NORTH CAROLINA AGRICULTURAL FOUNDATION, INC.

renders financial assistance through supplements in the development of strong teaching programs in agriculture and assists the Extension Service and Agricultural Experiment Station of the School of Agriculture at North Carolina State College.

THE NORTH CAROLINA DAIRY FOUNDATION, INC.

aims to promote and improve all phases of dairying in North Carolina through education, research, and extension. A Board of Directors of sixty persons handles the affairs of the Foundation; these directors represent distributors, producers, and jobbers.

THE NORTH CAROLINA ENGINEERING FOUNDATION, INC.

gives financial assistance to teaching, research, and extension in and through the School of Engineering.

THE NORTH CAROLINA TEXTILE FOUNDATION, INC.

was formed to promote the development of the School of Textiles, and was incorporated on December 31, 1942. Funds for this Foundation have been raised largely from textile manufacturing plants and other corporations and industries closely allied to textiles.

THE NORTH CAROLINA ARCHITECTURAL FOUNDATION, INC.

was organized in January, 1949. Foundation funds are used for the promotion and advancement of architectural education at North Carolina State College.

THE NORTH CAROLINA FORESTRY FOUNDATION

was incorporated April 15, 1929. The Foundation has acquired a tract of land known as the Hofmann Forest, consisting of about 80,000 acres in Jones and Onslow counties, which is used as a demonstration and research laboratory for forestry students.

PULP AND PAPER FOUNDATION, INC.

Incorporated December 19, 1954 by the southern pulp and paper mills, for the purpose of supporting the program of pulp and paper technology in the School of Forestry.

COLLEGE PUBLICATIONS

THE STATE COLLEGE RECORD

official publication of State College, is issued monthly and announces the results of special studies and of research by members of the faculty. The March issue is generally the annual Catalog, with announcements for the following year. Announcements concerning College Extension courses are also made through the *Record* series.

Brief notices of the short courses and special conferences which are held on the campus from time to time are issued by the Division of College Extension. The Director of Foundations likewise publishes brochures which are of special interest to North Carolinians.

THE STATELOG

is published monthly by the College to relate to the people of the state news of what is going on at State College and to strengthen the traditional link between the services of the College and the progress of the state. Subscription to the *Statelog* is free for all interested persons.

TECHNICAL AND SEMI-POPULAR BULLETINS

are issued by the Agricultural Experiment Station when research projects are completed or when they have progressed far enough that the results are seen to be of definite value. General publications interpreting the scientific findings of the Experiment Station or giving the results of Extension demonstrations are compiled by members of the Agricultural Extension staff and printed as circulars, folders, and pamphlets. Designed for popular use, these are usually written in a brief, clear style. Copies of these publications are sent free to citizens of the state upon request. Publication of these bulletins is announced by the press and radio of the state.

RESEARCH AND FARMING,

a quarterly bulletin journal written in popular style and giving the results of research and suggesting practical application of the information obtained is published by the Experiment Station.

EXTENSION FARM NEWS

published monthly, is the official house organ of the Extension Service. Subscription to both Research and Farming and Extension Farm News is free to citizens of North Carolina.

AGRICULTURE

An annual report published by the School of Agriculture contains a resume of activities of the Experiment Station, Extension Service, and Resident Teaching.

ENGINEERING SCHOOL BULLETINS

showing results of experimental and research projects in the School of Engineering are made available by the Department of Engineering Research.

ENGINEERING RESEARCH NEWS,

a quarterly publication of the Department of Engineering Research, is a review of current activities in the School of Engineering. Copies of these publications may be obtained from the Department.

TEXTILE PUBLICATIONS

pertaining to research may be secured from the Dean of the School of Textiles.

SUMMARY OF ENROLLMENT, 1957-58

RESIDENT STUDENTS

Regular Session

Freshmen	1,639
Sophomores	1,383
Juniors	1,168
Seniors	1,170
Professionals	29
Graduates	557
Specials and Unclassified	202
Auditors	21
	6,169
Men	6,020
Women	149
	6,169

EXTENSION, CONFERENCES, SHORT COURSES

July 1, 1957—June 30, 1958

Extension Classes	3,620
Correspondence Courses	2,604
Short Courses and Conferences	5,409
Gaston Technical Institute	239
	11,872

ENROLLMENT BY CURRICULA, 1957-58

REGULAR SESSION

SCHOOL OF AGRICULTURE

Agriculture	144
Agricultural Economics	31
Agricultural Engineering	71
Agri. and Biol. Chemistry	14
Agronomy	1
Animal Ecology	1
Animal Industry	81
Botany	2
Dairy Manufacturing	22
Entomology	4
Experimental Statistics	3
Field Crops	39
Horticulture	25
Mechanized Agriculture	23
Poultry Science	11
Rural Sociology	5
Soils	18
Wildlife Cons. and Mgt.	41
Zoology	10
Total	546

SCHOOL OF DESIGN

Architecture	193
Landscape Architecture	23
Total	216

SCHOOL OF EDUCATION

Agricultural Education	176
Industrial Arts	163
Industrial Education	2
Ind. and Rural Recreation	135
Mathematics Education	27
Science Education	13
Total	516

SCHOOL OF ENGINEERING

Ceramic	26
Chemical	215
Civil	508
Civil Engineering Const. Op.	154
Electrical	855
Engineering Mathematics	40
Engineering Physics	37
Furniture Mfg. and Mgt.	66
Geological	55
Heating and Air Cond.	64
Industrial	225
Mechanical	605
Mechanical Aero. Opt.	262
Metallurgical Eng.	19
Nuclear	303
Total	3,434

SCHOOL OF FORESTRY

Forestry	101
Forest Management	98
Pulp and Paper Technology	65
Wood Production Merchandising	21
Wood Technology	10
Total	295

SCHOOL OF TEXTILES

Textile Chemistry	53
Textiles	300
Total	353

NOT CLASSIFIED

Professionals	29
Unclassified Undergraduates, Auditors, and Special Students	223
Unclassified Graduates	25
Total	277

GRADUATE STUDENTS

Distribution of Graduate students by schools (included in above departmental classification):	
Agriculture	256
Education	74
Engineering	157
Forestry	21
Textiles	24
Total	532
GRAND TOTAL	6,169

TRUSTEES

THE CONSOLIDATED UNIVERSITY OF NORTH CAROLINA

North Carolina State College of Agriculture and Engineering
The University of North Carolina at Chapel Hill
The Woman's College at Greensboro

BOARD OF TRUSTEES

Luther H. Hodges, *Governor, Chairman Ex-Officio*
Arch T. Allen, *Secretary*
Charles F. Carroll, *State Supt. of Public Instruction, Member Ex-Officio*

TERM EXPIRING APRIL 1, 1961

Name	City	County
Wade Barber	*Pittsboro*	*Chatham*
Frank H. Brown, Jr.	*Cullowhee*	*Jackson*
Victor S. Bryant	*Durham*	*Durham*
John W. Clark	*Franklinville*	*Randolph*
W. Lunsford Crew	*Roanoke Rapids*	*Halifax*
R. Floyd Crouse	*Sparta*	*Alleghany*
Horton Doughton	*Statesville*	*Iredell*
A. C. Edwards	*Hookerton*	*Greene*
Henry A. Foscue	*High Point*	*Guilford*
Dr. L. J. Herring	*Wilson*	*Wilson*
Mrs. J. B. Kittrell	*Greenville*	*Pitt*
John D. Larkins, Jr.	*Trenton*	*Jones*
Dr. Harvey B. Mann	*Lake Landing*	*Hyde*
C. Knox Massey	*Durham*	*Durham*
Reid A. Maynard	*Burlington*	*Alamance*
Glenn C. Palmer	*Clyde*	*Haywood*
Edwin S. Pou	*Raleigh*	*Wake*
Mrs. S. L. Rodenbough	*Walnut Cove*	*Stokes*
A. Alex Shuford, Jr.	*Hickory*	*Catawba*
R. G. Stovall	*Roxboro*	*Person*
Dr. L. H. Swindell	*Washington*	*Beaufort*
Mrs. Charles W. Tillett	*Charlotte*	*Mecklenburg*
Carl V. Venters	*Jacksonville*	*Onslow*
J. Shelton Wicker	*Sanford*	*Lee*

TERM EXPIRING APRIL 1, 1963

Name	City	County
Mrs. Oscar Barker	*Durham*	*Durham*
Irwin Belk	*Charlotte*	*Mecklenburg*
Mitchell Britt	*Warsaw*	*Duplin*
Mrs. Mebane H. Burgwyn	*Jackson*	*Northampton*
S. N. Clark, Jr.	*Tarboro*	*Edgecombe*
T. J. Collier	*Bayboro*	*Pamlico*
A. Roy Cox	*Asheboro*	*Randolph*
Eugene Cross	*Marion*	*McDowell*
Ben E. Fountain	*Rocky Mount*	*Edgecombe*
O. Max Gardner, Jr.	*Shelby*	*Cleveland*
George Watts Hill	*Durham*	*Durham*
John H. Kerr, Jr.	*Warrenton*	*Warren*
M. C. Lassiter	*Snow Hill*	*Greene*
J. Spencer Love	*Greensboro*	*Guilford*
D. L. McMichael	*Madison*	*Rockingham*
Rudolph I. Mintz	*Wilmington*	*New Hanover*
Thomas O. Moore	*Winston-Salem*	*Forsyth*
Ashley M. Murphy	*Atkinson*	*Pender*
Mrs. B. C. Parker	*Albemarle*	*Stanly*
Mrs. Mary Stanford	*Chapel Hill*	*Orange*
Thomas Turner	*Greensboro*	*Guilford*
John W. Umstead, Jr.	*Chapel Hill*	*Orange*
Herman Weil	*Goldsboro*	*Wayne*
Sam L. Whitehurst	*New Bern*	*Craven*
Macon M. Williams	*Lenoir*	*Caldwell*

TERM EXPIRING APRIL 1, 1965

Name	City	County
Dr. Francis A. Buchanan	*Hendersonville*	*Henderson*
Dr. Jesse B. Caldwell	*Gastonia*	*Gaston*
Lenox G. Cooper	*Wilmington*	*New Hanover*
Marshall Y. Cooper	*Henderson*	*Vance*
Wilbur H. Currie	*Carthage*	*Moore*
Calvin Graves	*Winston-Salem*	*Forsyth*
Mrs. Albert H. Lathrop	*Asheville*	*Buncombe*
Dr. John G. Mebane	*Rutherfordton*	*Rutherford*
Larry I. Moore	*Wilson*	*Wilson*
Kemp B. Nixon	*Lincolnton*	*Lincoln*
Thomas J. Pearsall	*Rocky Mount*	*Nash*
Clarence L. Pemberton	*Yanceyville*	*Caswell*
James L. Pittman	*Scotland Neck*	*Halifax*
Mrs. Emily Harris Preyer	*Greensboro*	*Guilford*
H. L. Riddle, Jr.	*Morganton*	*Burke*
Roy Rowe	*Burgaw*	*Pender*
A. B. Smith, Jr.	*Dunn*	*Harnett*
John P. Stedman	*Lumberton*	*Robeson*
C. Lacy Tate	*Chadbourn*	*Columbus*
Dr. John C. Tayloe	*Washington*	*Beaufort*
H. P. Taylor	*Wadesboro*	*Anson*
W. Frank Taylor	*Goldsboro*	*Wayne*
F. E. Wallace	*Kinston*	*Lenoir*
Cameron S. Weeks	*Tarboro*	*Edgecombe*
Mrs. George Wilson	*Fayetteville*	*Cumberland*

TERM EXPIRING APRIL 1, 1967

Name	City	County
Arch T. Allen	*Raleigh*	*Wake*
Mrs. Ed M. Anderson	*West Jefferson*	*Ashe*
Ike F. Andrews	*Siler City*	*Chatham*
William C. Barfield	*Wilmington*	*New Hanover*
Mrs. J. W. Copeland	*Murfreesboro*	*Hertford*
Frank Hull Crowell	*Lincolnton*	*Lincoln*
Percy B. Ferebee	*Andrews*	*Cherokee*
Bowman Gray	*Winston-Salem*	*Forsyth*
Herbert Hardy	*Maury*	*Greene*
William B. Harrison	*Rocky Mount*	*Nash*
J. Frank Huskins	*Burnsville*	*Yancey*
Mack Jernigan	*Dunn*	*Harnett*
G. N. Noble	*Trenton*	*Jones*
Ernest E. Parker, Jr.	*Southport*	*Brunswick*
Frank Parker	*Asheville*	*Buncombe*
Claude W. Rankin	*Fayetteville*	*Cumberland*
T. Henry Redding	*Asheboro*	*Randolph*
Mrs. Dillard Reynolds	*Winston-Salem*	*Forsyth*
William P. Saunders	*Southern Pines*	*Moore*
Evander S. Simpson	*Smithfield*	*Johnston*
Walter L. Smith	*Charlotte*	*Mecklenburg*
Dr. Shahane Taylor	*Greensboro*	*Guilford*
Thomas B. Upchurch, Jr.	*Raeford*	*Hoke*
C. M. Vanstory, Jr.	*Greensboro*	*Guilford*
Hill Yarborough	*Louisburg*	*Franklin*

EXECUTIVE COMMITTEE OF THE BOARD

Luther H. Hodges, *Governor, Chairman Ex-Officio*
Arch T. Allen, *Secretary*
Billie Curtis, *Asst. Secy.*

Wade Barber
Victor S. Bryant
John W. Clark
George W. Hill
Mrs. Virginia T. Lathrop
Reid A. Maynard
Rudolph I. Mintz
G. N. Noble
Mrs. Rosa Parker
Thomas J. Pearsall
W. Frank Taylor
J. W. Umstead, Jr.

NORTH CAROLINA STATE COLLEGE, OFFICERS OF ADMINISTRATION

ADMINISTRATIVE COUNCIL

Carey H. Bostian, A.B., M.S., Ph.D., *Chancellor, Chairman*
M. E. Campbell, B.S., *Dean of the School of Textiles*
D. W. Colvard, B.S., M.S., Ph.D., *Dean of the School of Agriculture*
C. Addison Hickman, B.A., M.A., Ph.D., *Dean of the School of General Studies*
H. L. Kamphoefner, B.S., M.S., *Dean of the School of Design*
J. B. Kirkland, B.S., M.S., Ph.D., *Dean of the School of Education*
J. H. Lampe, B.S., M.S., Dr. Eng., *Dean of the School of Engineering*
W. J. Peterson, B.S., M.S., Ph.D., *Dean of the Graduate School*
R. J. Preston, A.B., M.F.S., Ph.D., *Dean of the School of Forestry*
L. L. Ray, *Assistant to the Chancellor in Charge of Development and Director of Foundations*
John W. Shirley, B.A., Ph.D., *Dean of the Faculty*
J. J. Stewart, Jr., B.S., M.A., *Dean of Student Affairs, Secretary*
J. G. Vann, *Business Manager*

COLLEGE POLICY

By action of the Trustees, the General Faculty includes all members of the College's teaching force above the rank of Instructor and all general administrative officers of the institution. In the President of the Consolidated University, the Chancellor of the College, and the General Faculty is vested final authority (under the Trustees) over all matters of College policy and activity. Under the General Faculty and Administrative Council, the Schools have separate Faculties and Administrative Boards (composed of all Department Heads) which have final authority over matters pertaining solely to their respective Schools, when not in conflict with Consolidated University and College regulations.

OFFICERS OF INSTRUCTION

As of July 1, 1958

WILLIAM CLYDE FRIDAY,
President, B.S., North Carolina State College; LL.B., University of North Carolina. LL.D., (Hon.) Wake Forest College, Belmont Abbey; Duke University, Princeton University.

WILLIAM M. WHYBURN,
Vice President, A.B., M.A., Ph.D., University of Texas; LL.D., Texas Technological College.

DONALD BENTON ANDERSON,
Provost, B.A., B.Sc.Ed., M.A., Ph.D., Ohio State University.

CAREY HOYT BOSTIAN,
Chancellor, A.B., Catawba College; M.S., Ph.D., University of Pittsburgh; D.Sc., (Hon.) Wake Forest College, Catawba College; D. Honoris Causa, National University of Engineering, Peru.

CATHERINE WEBER ABRUZZI,
Assistant Professor in Economics, B.A., M.A., University of California, Los Angeles.

WILLIAM ELTON ADAMS,
Coordinator of Student Affairs, School of Engineering, and Associate Professor of Mechanical Engineering, B.S., Ohio University; M.S., North Carolina State College.

FRED J. ALLRED,
Assistant Professor of Modern Languages, B.A., M.A., University of North Carolina.

RAUL ALVAREZ,
Assistant Professor of Industrial Engineering, B.S., University of Buenos Aires; M. S., North Carolina State College.

CHARLES NOEL ANDERSON,
Instructor in Mathematics, B.E.E., M.E.Math., North Carolina State College.

CLIFTON A. ANDERSON,
Head of the Department and Professor of Industrial Engineering, B.S., A.B., University of South Dakota; M.S., Pennsylvania State University; Ph.D., Ohio State University.

RICHARD LOREE ANDERSON,
Professor of Experimental Statistics, A.B., DePauw University; M.S., Ph.D., Iowa State College.

ROY NELS ANDERSON,
Head of Department of Occupational Information and Guidance, and Professor of Education, B.A., University of Denver; M.A., Ph.D., Columbia University.

ANTONIOS ANTONAKOS,
Assistant Professor of Physics, B.S., High Point College; M.S., Ph.D., University of North Carolina.

LILLIE HALL ANTONAKOS,
Instructor in English, A.B., Winthrop College; M.A., Ph.D., University of South Carolina.

JAY LAWRENCE APPLE,
Assistant Professor of Plant Pathology, B.S., M.S., Ph.D., North Carolina State College.

CLARENCE MONROE ASBILL, JR.,
Professor of Textile Machine Design and Development, B.S., Clemson College.

WILLIAM BLAND ASKREN,
Director, Industrial Psychology Center and Assistant Professor of Psychology, A.B., Wittenberg College; M.S., Ph.D., Purdue University.

LEONARD WILLIAM AURAND,
Research Associate Professor of Animal Industry, B.S., Pennsylvania State College; M.S., University of New Hampshire; Ph.D., Pennsylvania State College.

WILLIAM WYATT AUSTIN, JR.,
Head of Department and Professor of Metallurgical Engineering, B.S., Birmingham Southern College; M.S., Ph.D., Vanderbilt University.

AUSTIN ROBERT BAER,
Associate Professor of Product Design and Head of Department, Georgia Institute of Technology and Massachusetts Institute of Technology.

BRUCE LLOYD BAIRD,
Research Instructor in Soils, B.S., M.S., Utah State College.

ERNEST HALL,
Professor of Botany, B.S., M.S., Oklahoma University; Ph.D., University of California.

STANLEY THOMAS BALLENGER,
Associate Professor of Modern Languages, B.A., M.A., University of North Carolina.

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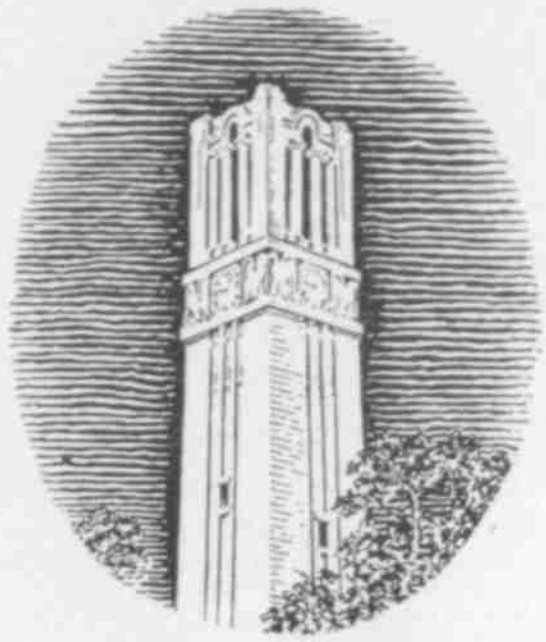
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