North Carolina State College

State College Record

General Catalog
1961 - 1962

NORTH CAROLINA STATE COLLEGE RECORD

North Carolina State College

of the University of North Carolina

Catalog Issue
1961 - 1962

Announcements for Sessions 1961-1963

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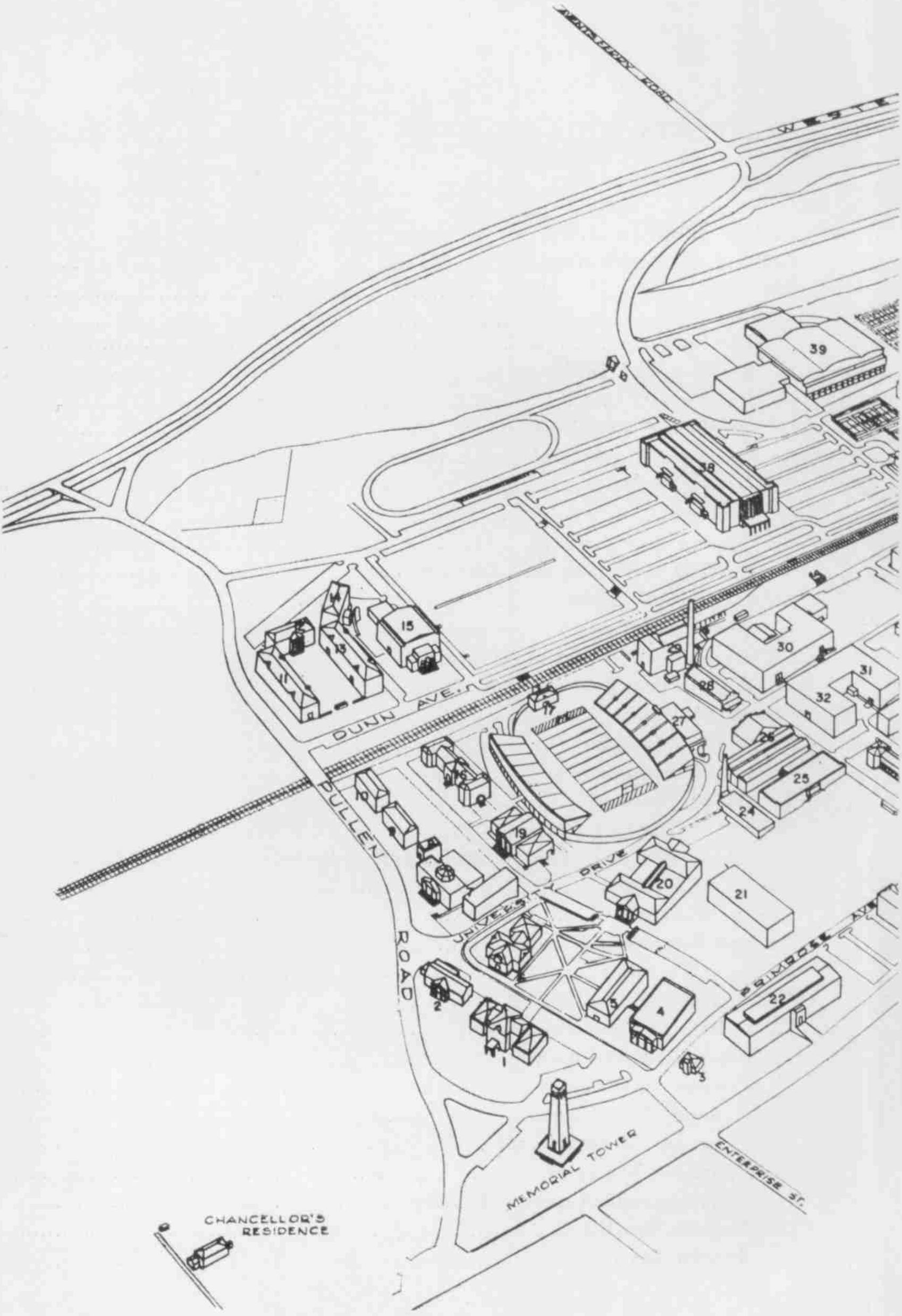
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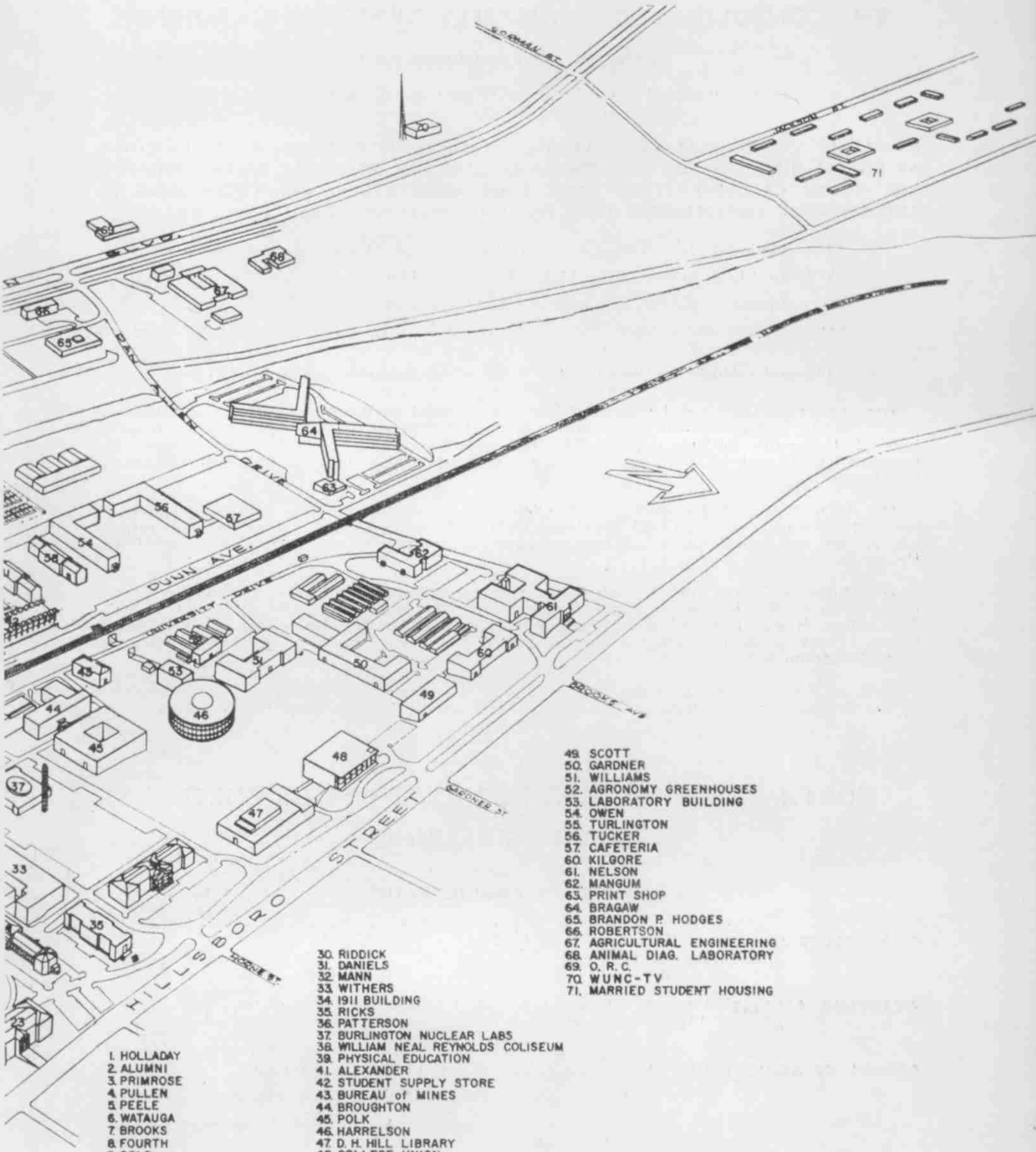

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NORTH CAROLINA STATE COLLEGE
1960

THE CONSOLIDATED UNIVERSITY OF NORTH CAROLINA

OFFICERS OF ADMINISTRATION

(General Administrative Officers at Chapel Hill)

BY ACT OF THE GENERAL ASSEMBLY OF 1931 THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL, THE NORTH CAROLINA COLLEGE FOR WOMEN AT GREENSBORO, AND THE NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING AT RALEIGH WERE CONSOLIDATED INTO THE UNIVERSITY OF NORTH CAROLINA.

The administrative officers of The University of North Carolina are:

William Clyde Friday, B.S., LL.B., LL.D., President

Vice President and Finance Officer (Position Vacant)

Donald Benton Anderson, B.A., B.Sc. Ed., M.A., Ph.D., Vice President for Graduate Studies and Research

Alexander Hurlbutt Shepard, Jr., A.B., M.A., Business Officer and Treasurer

The Vice President and Finance Officer has general administrative responsibilities and is specifically concerned with the development programs of the University, the presentation of University budget requests to the several agencies of state government, the Escheats Fund, and relationships with national foundations and agencies of the federal government.

The Vice President for Graduate Studies and Research, working with the University Graduate Executive Council and the three Deans of the Graduate School, has the responsibility for the coordination of the graduate offerings and research programs of the University.

The Business Officer and Treasurer has the responsibility of over-all supervision of the preparation of the University budget requests and the expenditure of authorized budgets. This officer is also responsible for the administration within the University of those enactments of the General Assemblies that relate to the classification of personnel under the State Personnel Act.

Each of these officers and the Chancellors of the component institutions are responsible to the President as the principal executive officer of the University of North Carolina.

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING

OFFICERS OF ADMINISTRATION

CHANCELLOR John Tyler Caldwell, B.S., M.A., Ph.D.
"A" Holladay Hall

ACADEMIC AFFAIRS John W. Shirley, B.A., Ph.D., Dean of the Faculty, 110 Holladay Hall

SCHOOL OF AGRICULTURE H. Brooks James, Dean, 115 Patterson Hall

E. W. Glazener, Director of Instruction, 111 Patterson Hall

R. L. Lovvorn, Director, Agricultural Experiment Station, 105 Patterson Hall

Charles W. Williams, Administrative Officer, 101-B Patterson Hall

R. W. Shoffner, Director, Agricultural Extension Service, 104 Ricks Hall

SCHOOL OF DESIGN H. L. Kamphoefner, Dean, 200 Brooks Hall

SCHOOL OF EDUCATION J. B. Kirkland, Dean, 119 Tompkins Hall

SCHOOL OF ENGINEERING J. H. Lampe, Dean, 229 Riddick Building
R. G. Carson, Jr., Director of Instruction, 232 Riddick Building
N. W. Conner, Director, Engineering Research, 124 Riddick Building
W. C. Bell, Director, Industrial Experimental Program, Old Ceramic Building

SCHOOL OF FORESTRY R. J. Preston, Dean, 162 Kilgore Hall

SCHOOL OF GENERAL STUDIES Fred V. Cahill, Jr., Dean, 103 Peele Hall

SCHOOL OF PHYSICAL SCIENCES AND APPLIED MATHEMATICS Arthur Clayton Menius, Jr., Dean, Riddick Building
Carey G. Mumford, Assistant to the Dean, Riddick Building

SCHOOL OF TEXTILES M. E. Campbell, Dean, 101 Nelson Building

GRADUATE SCHOOL Walter J. Peterson, Dean, 145 Gardner Hall

WUNC-TV Roy J. Johnston, Director of Television
Charles A. Idol, Engineer in Charge

LIBRARY H. C. Brown, Librarian, D. H. Hill Library

COLLEGE EXTENSION E. W. Ruggles, Director, College Extension Division, 118 1911 Building

STUDENT AFFAIRS James J. Stewart, Jr., Dean, 101 Holladay Hall

ADMISSIONS AND REGISTRATION K. D. Raab, Director, Holladay Hall

STUDENT ACTIVITIES B. C. Talley, Jr., Director, 206 Holladay Hall
RELIGIOUS PROGRAMS O. B. Wooldridge, Jr., Director, Y.M.C.A.
MUSIC ACTIVITIES R. A. Barnes, Director, 102 Pullen Hall
COLLEGE UNION G. O. T. Erdahl, Director, College Union

STUDENT HOUSING N. B. Watts, Director, 207 Holladay Hall

DEPARTMENT OF COUNSELING Lyle B. Rogers, Director, 201 Holladay Hall

STUDENT HEALTH SERVICE J. J. Combs, College Physician, Clark Hall

MILITARY TRAINING Air Force ROTC, Col. Robert C. Paul, 145 Coliseum
Army ROTC, Col. L. W. Merriam, 154 Coliseum

INTERCOLLEGIATE ATHLETICS Roy B. Cloaston, Athletics Director and Director of Coliseum, 102 Coliseum

DEVELOPMENT AFFAIRS L. L. Ray, Director of Development and Foundations, "A" Holladay Hall
H. W. Taylor, Director of Alumni Affairs, Alumni Building
Rudolph Pate, Director of News Bureau, Watauga Hall

BUSINESS AFFAIRS J. G. Vann, Business Manager, 105 Holladay Hall
John E. Hills, Assistant Business Manager, Holladay Hall
W. L. Fleming, Director of Married Student Housing
John D. Wright, Director of Accounting and Budgets, Holladay Hall
John C. Williams, Purchasing Agent, 1911 Building
J. M. Smith, Director of Maintenance and Operations, College Engineer, Morris Building
James S. Fulghum, Jr., Supervisor of Dormitory Rentals, 4 Holladay Hall
A. G. Sutherland, Director of Dining Halls, Leazar Dining Hall
L. L. Ivey, Manager of Student Stores, Y.M.C.A. Building

COLLEGE CALENDAR

FALL SEMESTER, 1961

September 11	Monday	General Faculty Meeting.
September 11-13	Monday-Wednesday	Orientation of new students.
September 14	Thursday	Freshman registration.
September 15	Friday	Upperclassman registration. Late registration fee of $5.00 payable by all who register after September 15.
September 15-16	Friday-Saturday	Continuation of new student orientation.
September 18	Monday	Classes begin at 8:00 a.m.
September 22	Friday	Last day for registration. Last day for refund less $5.00 registration fee.
September 29	Friday	Last day to add a course.
October 6	Friday	Last day to drop a course without failure.
November 11	Saturday	Mid-term reports.
November 22	Wednesday	Thanksgiving holidays begin at 1:00 p.m.
November 27	Monday	Classwork resumes at 8:00 a.m.
November 28	Tuesday	Last day to withdraw from school without failures.
December 19	Tuesday	Christmas holidays begin at 6:00 p.m.
January 3, 1962	Wednesday	Classwork resumes at 8:00 a.m.
January 16	Tuesday	Last day of classes.
January 17	Wednesday	Reading Day.
January 18-24	Thursday-Wednesday	Final Examinations.

SPRING SEMESTER, 1962

February 1	Thursday	Orientation of new students.
February 2	Friday	Registration.
February 5	Monday	Classes begin at 8:00 a.m.
February 9	Friday	Last day to register. Last day for refund less $5.00 registration fee.
February 16	Friday	Last day to add a course.
February 23	Friday	Last day to drop a course without failure.
March 24	Saturday	Mid-term reports.
April 6	Friday	Last day for withdrawing from school without failures.
April 19	Thursday	Easter holidays begin at 12:00 noon.
April 25	Wednesday	Classwork resumes at 8:00 a.m.
May 24	Thursday	Last day of classes.
May 25	Friday	Reading Day.
May 26-June 1	Saturday-Friday	Final Examinations.
June 2	Saturday	Commencement.

SUMMER SESSIONS, 1962

First Session

June 11	Monday	Orientation of new students.
June 12	Tuesday	Registration.
June 13	Wednesday	First day of classes.
June 18	Monday	Last day for registration and last day to withdraw with refund.
June 22	Friday	Last day for dropping courses without failure and last day to withdraw without failure.
July 4	Wednesday	Holiday.
July 18	Wednesday	Last day of classes.
July 19	Thursday	Final Examinations.

Second Session

July 19	Thursday	Orientation of new students.
July 20	Friday	Registration.
July 23	Monday	First day of classes.
July 27	Friday	Last day for registration and last day to withdraw with refund.
August 1	Wednesday	Last day for dropping courses without failure and last day to withdraw without failure.
August 23	Thursday	Last day of classes.
August 24	Friday	Final Examinations.

FALL SEMESTER, 1962 -63

September 10	Monday	General Faculty Meeting.
September 10-12	Monday-Wednesday	Orientation of new students.
September 13	Thursday	Freshman registration.
September 14	Friday	Upperclassman registration. Late registration fee of $5.00 payable by all who register after Sept. 14.
September 14-15	Friday-Saturday	Continuation of new student orientation.
September 17	Monday	Classes begin at 8:00 a.m.
September 21	Friday	Last day for registration. Last day for refund less $5.00 registration fee.
September 28	Friday	Last day to add a course.
October 5	Friday	Last day to drop a course without failure.
November 10	Saturday	Mid-term reports.
November 21	Wednesday	Thanksgiving holidays begin at 1:00 p.m.
November 26	Monday	Classwork resumes at 8:00 a.m.
November 27	Tuesday	Last day to withdraw from school without failures.
December 19	Wednesday	Christmas holidays begin at 6:00 p.m.
January 3, 1963	Thursday	Classwork resumes at 8:00 a.m.
January 17	Thursday	Last day of classes.
January 18	Friday	~~Reading Day~~.
January 19-25	Saturday-Friday	Final Examinations.

SPRING SEMESTER, 1963

January 31	Thursday	Orientation of new students.
February 1	Friday	Registration.
February 4	Monday	Classes begin at 8:00 a.m.
February 8	Friday	Last day to register. Last day for refund less $5.00 registration fee.
February 15	Friday	Last day to add a course.
February 22	Friday	Last day to drop a course without failure.
March 23	Saturday	Mid-term reports.
April 5	Friday	Last day for withdrawing from school without failures.
April 11	Thursday	Easter holidays begin at 12:00 noon.
April 17	Wednesday	Classwork resumes at 8:00 a.m.
May 23	Thursday	Last day of classes.
May 24	Friday	Reading Day.
May 25-31	Saturday-Friday	Final Examinations.
June 1	Saturday	Commencement.

General Information

HOLLADAY HALL is the oldest campus building and was once the total college plant. The historial edifice now houses central administration which includes the chancellor's suite, business office, foundations, dean of faculty, dean of student affairs, and registrar's office.

Familiar Campus Scenes

E. S. KING Religious Center is a gathering place for State College students. The Center houses Danforth Chapel which is a non-denominational house of prayer, meditation, and worship.

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 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 1917, the institution's name was changed to the North Carolina State College of Agriculture and Engineering.

In 1931, the General Assembly formed the Consolidated University of North Carolina, embracing the University of North Carolina in Chapel Hill, North Carolina State College of Agriculture and Engineering in Raleigh, and the Woman's College in Greensboro.

Following World War II, when college personnel and facilities were involved primarily in the national defense effort, State College expanded greatly. Returning service men nearly tripled any previous enrollment, and today's student body has stabilized at more than twice the pre-war level. State College today is one of the best-housed and best-equipped technological institutions of higher learning 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 beginning its 72nd year of service, the college has a regular enrollment averaging 6,300 in a $50 million plus plant, on a campus of 72 major buildings, eight schools, 54 departments, with a teaching staff of nearly 600 and a total staff of 2,000 including administrative, extension, and research personnel across the State.

Students of North Carolina 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. 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 through research.

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 any citizen faces. In working toward this broad objective, State College is organized into eight main instructional divisions: School of Agriculture, School of Design, School of Education, School of Engineering, School of Forestry, School of General Studies, School of Physical Sciences and Applied Mathematics, and School of Textiles.

With the exception of the School of General Studies, each of these divisions offers numerous curricula leading to baccalaureate degrees. The curricula are explained in 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 provides instruction in the liberal arts and the humanity. 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 on the campus include 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 services, to the boundaries of the State and beyond into the whole Southern region. But the focal center of these widespread activities is the State 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.

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 Nuclear Laboratories.

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 administration.

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

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 lectures.

Married Student Housing Center . . . the center includes 300 units and features 120 efficiency, 148 one-bedroom, and 32 two-bedroom apartments.

Burlington Nuclear Laboratories . . . 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 the nation's most modern student-faculty activities centers, with a main lounge, cloak room, snack bar, dining room, two 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, seven 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 Diagnostic Laboratory, Reuben B. Robertson Pulp and Paper Laboratory, Nelson Textile Building, Riddick Engineering Laboratories, Brooks Hall (a union of traditional and contemporary architecture), a new gymnasium, and TV studios along Western Boulevard.

Now under construction is a completely modern class room building, close to the library and the student center of the campus.

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 for both the fall and spring semesters will be considered as early as they are submitted. The deadline for the fall semester admission applications is September 1 and the deadline for the spring semester is January 1. Information concerning graduate student admission is found in the Graduate School Catalog 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 the College Entrance Examination Board tests 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 (earning credit but not working for a degree at North Carolina State College); and auditor (no credit).

To be admitted as a regular, degree-seeking student, freshmen must submit a certificate of graduation from an accredited high school. It is possible for graduates of non-accredited high schools and for mature persons who have not completed high school to have individual consideration for admission. Special examinations may be required in such instances. All transfer students except auditors must have transcripts sent to the State College Office of Admissions directly from each other college attended. Detailed regulations which apply in all cases are discussed in the following paragraphs and should be examined carefully by the prospective student.

Admission requirements are as follows:

1. **Freshmen**—The applicant should be of sound moral character and the graduate of an accredited high school. Applicants must take the Scholatic Aptitude Test of the College Entrance Examination Board. Scores on this test and the high school record will be considered together in determining admissibility. He must have at least 16 units of completed high school work, 8½ of which are distributed as follows:

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

The remainder of the 16 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—Students who show lack of proficiency in English by scores made on the entrance examination are advised to take a special non-credit course in English composition before taking the regular credit course in English. This remedial work may be taken in summer school or by correspondence before the first regular semester. Such students usually are invited to come to the college for counseling and further testing to help them plan their preparation. Students with high marks on the verbal

part of the entrance examination are invited to participate in an accelerated English program. Foreign students lacking 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 proceed with regular courses in English.

Mathematics—One and one-half units of algebra and one unit of plane geometry are minimum preparation for all curricula. Students in Engineering, Design, Agricultural Engineering, Physical Science and Applied Mathematics, and Mathematics Education must present solid geometry for admission or take a special non-credit course offered for applicants who have not taken solid geometry in high school. A student may not be regularly enrolled at the college until deficiences (with the exception of solid geometry) are removed. He must either complete required courses in mathematics in high school before applying to State College, or take them in summer school or by correspondence from the Extension Division of the college prior to entering.

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 that course, he will receive college credit for it. Foreign students are required to complete a course in American History before graduation.

2. **Transfers**—*Admission with Advanced Standing*—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. No previously earned credit can be erased from a student's record. Failure of the student to present transcripts from all colleges previously attended may result in his dismissal from State College.

Students seeking to transfer with fewer than 29 semester hours of college credit will ordinarily be required to meet the entrance examination standards which apply to beginning freshmen. Students with 29 semester hours of college credit but lacking credit with average grade or better in both college algebra and college English, and students seeking to transfer from non-accredited institutions, also must meet the examination requirement.

3. **Unclassified Students**—Admission of 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.

4. **Special Students**—*No College Credit*—Admission to the college in this category requires the recommendation of the dean of the school concerned and will be granted only 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 intercollegiate contest or become a member of any fraternity, professional or social. Work taken as a special student does not carry college credit.

5. Auditor—Admission as an auditor requires the permission of the instructor and department head. 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.

6. Readmission of Former North Carolina State College Students—To be readmitted after having withdrawn from the college or after having been out of school for one or more semesters, the student should apply to the Office of Admissions and Registration for readmission at least 30 days prior to the date of desired enrollment.

7. Graduate Students—All students working toward advanced degrees are enrolled in the Graduate School. Procedures and policies governing graduate instruction are outlined in a special catalog issued by the school. Any student interested in enrolling for graduate study may obtain a copy of The Graduate School Catalog from:

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

GRADES AND SCHOLARSHIP

Grading System—North Carolina State College operates on a credit-point system. Semester credits represent the number of hours completed with a passing grade; quality points are determined by the grade 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, FA, FD Failing	**0 quality point for each credit hour**
AU Audit	**0 credit hours and 0 quality points**
AB Absent from examination	
IN Incomplete	
S Satisfactory (for graduate students)	
U Unsatisfactory (for graduate students)	
P Passed (for graduate students)	
D* Failure removed by re-examination (for seniors only)	

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 the 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 has 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.

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 re-examination on the total subject matter of the course.

If a senior fails more than one course during the next to the last semester and removes all but one of these deficiencies by repeating the course or courses, and if he has not had another re-examination, he may apply at the end of his last semester in residence for permission to take a re-examination. When such a re-examination is taken to remove an "F", only the re-examination will be counted. And a senior who has passed a re-examination will have his grade for this course changed from "F" to D*, which is equivalent in quality points to a grade of "D". A fee of $5.00 will be charged for such a re-examination.

During the first two years of residence at this institution and the summer sessions immediately following (or until 63 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, only the last grade 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.

Scholarship Standards—*Semester Rule*—Any student carrying 14 or more semester hours must pass at least six hours his first semester and eight hours each semester thereafter. Students carrying less than 14 hours must pass at least half of the work in order to continue.

1.5 to 2.0 Average Rules—Students who have 40 or more semester hours of college credit are expected to maintain a 2.0 quality point average. Students who have fewer than 40 semester hours are expected to maintain a 1.5 quality point average. Any student who fails to meet these standards shall be placed on provisional status. Students will enter provisional status at the start of either the fall or spring semester. Any student on provisional status who fails to meet scholarship standards within two semesters and included summer sessions will be suspended.

In addition to the 29 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.

Graduation Requirement—A student is scholastically eligible for graduation when he has satisfied all the specific requirements of his department, his school, and the college, and has earned at least an accumulated 2.0 average.

To be graduated with high honors, the student shall have attained a 3.5 quality point average on all semester hours carried at this institution (or at one or both of the other units of the University of North Carolina).

To be graduated with honors, the student shall have attained a 3.0 quality point average on all semester hours carried at this institution (or at one or both of the other units of the University of North Carolina).

Residence Requirement—A candidate for the bachelor's degree who transfers from some other institution must spend at least one academic year in residence and earn a minimum of 24 semester hours before being eligible for a degree. Residence at the other two units of the University of North Carolina is considered residence at this institution.

Classification Requirements—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.

Freshman:	**1-28 semester hours of earned credit**
Sophomore:	**29-62 semester hours of earned credit**
Junior:	**63-96 semester hours of earned credit**
Senior:	**97 or more semester hours of earned credit**
Professional (School of Design):	**140 or more semester hours**

GENERAL POLICIES

Grades and Residence at Other Units of The University of North Carolina—For courses transferred from the University of North Carolina at Chapel Hill and the Woman's College at Greensboro the student receives full credit and the same quality points he would have received if the same grades had been made on these courses at North Carolina State College. Residence is also interchangeable.

Required Freshman English and Required Physical Education—Each student is expected to schedule required freshman English and required freshman and sophomore physical education every semester until these courses are passed satisfactorily.

Withdrawals from the College—Students who desire to leave college during a semester or summer session must withdraw officially. There is no penalty if a student withdraws prior to the date specified in the college calendar as the last date for withdrawing without failures. Failures are recorded on all courses for students who withdraw after that date. A student who desires to withdraw should report to the Counseling Center in Holladay Hall for a withdrawal blank and instructions. A student completing a semester or summer session and not planning to return need not officially withdraw.

Changes in Curricula—Students may change from one curriculum to another by filing with the Office of Registration (at the time of registration) a curriculum change card signed by the dean or director of instruction concerned. Such changes are effective only at the beginning of a semester or summer session.

Scholastic Loads—A student may not carry more than 21 semester hours, nor less than 12 semester hours, during a regular semester without securing the written approval of the dean or director of instruction of his school. For a six-week summer session a student must have the same approval if he carries more than seven semester hours. Veterans or other students receiving federal educational benefits must meet the load requirements of the appropriate federal agency.

RESIDENCE STATUS FOR TUITION PAYMENT

The tuition charge for legal residents of North Carolina is less than for nonresidents. A legal resident of North Carolina is one who has his domicile in this state. It is important that each applicant for admission and each enrolled student know his residence status for tuition payment and understand the regulations governing residence status. The following regulations cover most factual situations:

1. A person 21 years of age or older is not deemed eligible for the lower tuition rate unless he has maintained his legal residence in North Carolina for at least the six months next preceding the date of his first enrollment in an institution of higher education in this state.

2. The legal residence of a person under 21 years of age at the time of his first enrollment in an institution of higher education in this state is that of his parents, surviving parent, or legal guardian. In cases where parents are divorced or legally separated, the legal residence of the father will control unless custody of the minor has been awarded by court order to the mother or to a legal guardian other than a parent. No claim of residence in North Carolina based upon residence of a guardian in North Carolina will be considered if either parent is still living unless the action of the court appointing the guardian antedates the student's first enrollment in a North Carolina institution of higher education by at least 12 months.

3. The residence status of any student is determined as of the time of his first enrollment in an institution of higher education in North Carolina and may not thereafter be changed except: (a) in the case of a nonresident minor student at the time of his first enrollment whose parents have subsequently established legal residence in North Carolina; and (b) in the case of a resident who abandons his legal residence in North Carolina. In either case, the appropriate tuition rate will become effective at the beginning of the semester or term next following the date of change of residence status.

4. The legal residence of a wife follows that of her husband, except that a woman student currently enrolled in this institution as a resident may continue as a resident even though she marry a nonresident.

5. Military personnel attached to military posts or reservations in North Carolina are not considered eligible for the lower tuition rate unless they have maintained a legal residence in the state for at least the six months next preceding the date of first enrollment in an institution of higher education in the state.

6. Aliens lawfully admitted to the United States for permanent residence who have established a legal residence in North Carolina according to Paragraphs number 1, 2, or 4, above, are eligible for the lower tuition rate.

7. Ownership of property in or payment of taxes to the State of North Carolina apart from legal residence will not qualify one for the lower tuition rate.

8. Discretion to adjust individual cases within the spirit of these regulations is lodged in the Vice President and Finance Officer of the University.

Any student or prospective student in doubt concerning his residence status must bear the responsibility for securing a ruling by stating his case in writing to the Chancellor.

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; (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 of each semester. 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	$324	$317
Design	148	142	323	317
Education:				
Agricultural Education	149	142	324	317
Others	146	140	321	315
Engineering	148	142	323	317
Forestry	158	142	333	317*
Physical Sciences and Applied Mathematics	148	142	323	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 Seven Hours—Undergraduate students taking one course of not more than four 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 five or six 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 $9.00 covering cost of diploma and rental 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 members may register for one three hour 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 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 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 $2.00 for his room and mail box keys. This deposit will be refunded when the keys are returned to the Dormitory Rental Office. 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 compiled 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 $550 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 $100 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—Items such as tuition, fees, and room rent in dormitories are fixed. Others are variable with the individual student.

	First Semester	*Second Semester*	*Year*
Tuition (Non-resident students add $295.00 per semester)	$ 75	$ 75	$150
Other College Fees	73	67	140
General Deposit (Paid only upon first enrollment)	20		20
Room	85	85	170
Board	250-300	250-300	500-600
Books and supplies	50-100	25	75-125
Other personal expenses and incidentals	100-150	100-150	200-300
Total (N. C. residents)	$653-803	$602-702	$1255-1505
Total (non residents)	$828-987	$777-877	$1605-1855

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 $5.00 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 a $10 reservation fee.

b. During the registration period, the rent paid will be refunded less a $10 reservation fee or a charge of $1.00 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:

Supervisor of Dormitory Rentals
Room 4
Holladay Hall
North Carolina State College
Raleigh, North Carolina

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 at which time a correct mailing address must be given. Refund will be made by check after 30 days from date 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. 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 a student enters State College, he 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.

The student also becomes part of the Honor System. He is expected to adhere to its general aims which are honesty in class work and honor in general conduct.

Clubs and Societies—Through the various honorary, professional, technical, and social orgainzations at State College, the interested student finds many opportunities to participate in activities that appeal to him and to meet others who have similar interests.

College Honorary—Honorary societies and fraternities at State College are Golden Chain, senior leadership; Blue Key, junior leadership; Thirty and Three, sophomore leadership; Phi Eta Sigma, freshman scholarship; and Phi Kappa Phi, junior, senior, and graduate student scholarship.

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—Eighteeen national social fraternities have chapters at State College. Each sends two representatives to 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 general public.

The social fraternities are Alpha Gamma Rho, Delta Sigma Phi, Farmhouse, Kappa Alpha, Kappa Sigma, Lambda Chi Alpha, Phi Epsilon Pi, Phi Kappa Tau, Pi Kappa Alpha, Pi Kappa Phi, Sigma Alpha Epsilon,

Sigma Alpha Mu, Sigma Chi, Sigma Nu, Sigma Phi Epsilon, Sigma Pi, Tau Kappa Epsilon, and Theta Chi.

State College has one sorority, Sigma Kappa, which recently was organized.

Student Publications—State College has a variety of publications, both general and school-sponsored, edited and managed by student officers, with faculty members serving as advisers. A student may gain journalistic experience and training in writing, editing, or management by working on these publications.

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. The yearbook recalls in pictures the varied activities of the student body throughout the year and is published for the entire student body.

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 Technican is a student newspaper, issued three times 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. Juniors and seniors may take physical education as an elective.

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 and college credit is not given. Competition in 13 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 student representatives 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. Fields are provided for intramural and recreational play. Six semi-hard-surface and 14 hard-surface courts are available for tennis. The construction of additional courts is being considered.

The new gymnasium has 10 four-wall handball courts, six squash courts, and separate rooms for boxing and wrestling, golf, correctives and weight-lifting. The main gymnasium floor provides seven basketball courts which may be adjusted to accommodate eight volleyball courts, 20 badminton courts, indoor tennis, and various other sports. This space also includes a gymnastic area the size of a regulation basketball court.

The swimming pool, located in an adjoining building, is 25 meters by 25 yards with two one-meter and one three-meter diving boards.

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

The program in intercollegiate athletics consists of the organizations 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 College include Riddick Stadium, a 20,000-seat stadium for football; William Neal Reynolds Coliseum, a 12,500-seat arena for basketball; six football practice fields, 20 tennis courts, two 25-yard swimming pools, one of olympic dimensions; two gymnasiums, one new; a basketball field, and facilities in the Coliseum for wrestling and other sports.

Music—Since the early days of North Carolina State College, its musical organizations have played an important part 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 and radio. The club also makes tours and provides small ensemble music for special occasions.

The Symphonic Band, the *Fanfare Band*, the *Marching Band*, and the *ROTC Band* make up the four divisions of the North Carolina State Bands. Each band serves a specific purpose in the musical life on 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 ROTC Band consists of freshman and sophomore ROTC and AFROTC students. Participation in band excuses the student from all ROTC drill on the field.

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 concerning music activities can be obtained by writing or visiting the Director of Music in Pullen Hall.

Student Centers—The student at State College finds that a great deal of his extra-curricular activity centers around two buildings, the *E. S. King Religious Center* and the *College Union*. The E. S. King Religious Center 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 floors are a snack bar, a small dining room, game rooms, a barber shop, and telephones. The main floor has a ballroom (which may be used for an assembly room), a library, lounges, a gallery area for exhibits, and facilities for two small dining rooms. The second floor houses the College Union offices, a photographic darkroom, guest rooms, a quiet room, a room for listening to music, a theater, 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 meet their friends. Through its widely varied program, however, the Union 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 the student may display his artistic talents in the form of exhibits, workshops, and entertainment. 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 held within the E. S. King Religious Center. 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, located in the center, provides a place for religious services and meditation for all faiths.

The E. S. King Religious Center 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 microfilming 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 more than 212,000 volumes. More than 3,000 journals are received currently, and more than 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 and for acquiring knowledge. It also can be a place for discovering all the wealth of pleasure and of widened understanding which books can bring to the student who desires to become a man of education and stature.

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

Housing—At State College, 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 he has an opportunity to meet and make friends with students of variant backgrounds, to use his leisure time pleasantly and profitable, 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. 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. They must make their own housing arrangements. A list of available off-campus rooms for rent is maintained at the Dormitory Rental Office in Room 4, Holladay Hall.

For the married student, the college has for rent 300 permanent efficiency, one and two bedroom apartments. Priority of occupancy will go to graduate students first, prior military servicemen eligible for government educational benefits second, and all other married students third.

At the beginning of the 1960-61 academic year, approximately 326 students were housed in off-campus residences maintained by the 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.

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.

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 facility, provides four cafeteria lines where the student may secure nutritious food at reasonable prices. Meals are served cafeteria style and the cost depends upon the selection of food by the student. A typical student may spend approximately $2.00 per day or $550 a year for meals, although some students may eat at the college cafeteria for as low as $1.25 per day or $300 a year.

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. The rates are inexpensive.

Linen Rental Plan—This service provides for an initial issue of two sheets, one pillow case, three 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 enters school. The service is available to all students at a cost of $20 per school year. Applications for the linen rental plan are mailed with dormitory room forms, or they may be obtained from the Dormitory Rental Office.

Barber Service—Two barber shops are provided, one in the E. S. King Religious Center and one in the College Union.

Books and Supplies—State College's ultra-modern *Student Supply Store* located on Dunn Avenue houses an excellent book department, general student supplies, engineering equipment, and a fountain-snack bar.

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

Health—State College seeks to safeguard the health of the student in every way possible. The college maintains a 76-bed infirmary, open 24 hours a day, with 15 staff members. There are college physicians, a supervising nurse, a night supervisor, six general duty nurses, one full-time laboratory and X-ray technician, and four other employees. 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 pro-

vide 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 in order 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—As described in the section on Housing, student dormitory managers and floor managers and the hosts and hostesses assigned to the larger dormitories provide help with various questions and problems.

Counseling Center—The Counseling Center, located on the second floor of Holladay Hall, has a staff of full-time counselors to help students with problems of vocational and curricular choice, and personal adjustment. The center is prepared to administer various aptitude and interest tests and maintains a file of occupational information. Referral can be made for students desiring remedial work in speech, reading, and other special areas.

Students may come to the center on their own initiative or may be referred by teachers, advisers, or other members of the college staff. There is no cost to the student for conferences but there is a small materials fee in cases where a battery of tests is administered.

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, graduate fellowships and assistantships, loans, athletic awards, and part-time jobs.

Financial aid other than graduate fellowships and assistantships 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 are outright grants to undergraduates and include those which are available generally, without regard to curriculum, and those restricted to the students of particular schools or departments.

Scholarship applications from entering freshmen are handled under what is known as the Talent For Service Scholarship Program. One application, which should be filed by January 1st preceding the September of expected first enrollment, obtains consideration for essentially all scholarships available. Periodically, the college publishes a full listing of scholarships available to State College students. Copies of these lists may be obtained from the Student Financial Aid Office.

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 government agencies, professional groups, and business organizations. Applicants for fellowships should contact the head of the department in which they wish to pursue studies.

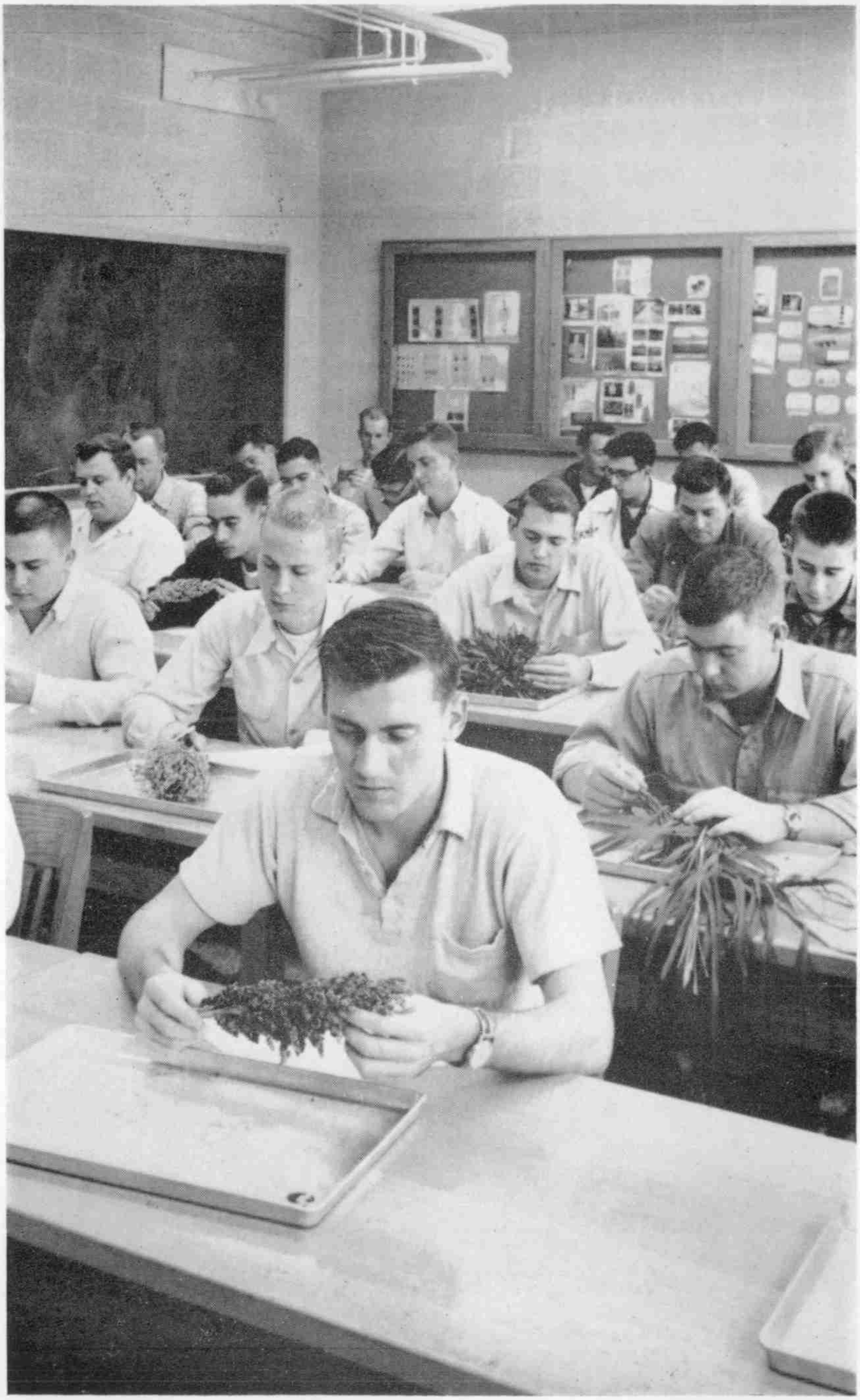
Graduate Assistantships are short-term staff appointments that carry stipends ranging from $1,200 to $4,800 depending upon the magnitude of the service obligation and the experience of the appointee. Teaching assistants are customarily appointed annually for the nine months academic year. Research assistants 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.

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

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 $500 per student per year. Short-term emergency loans, generally not exceeding $50 are also available. State College participates in the National Defense Student Loan Program. Plans for budgeting college costs over a period of years are available to State College students and their parents. Pre-Paid Education Plans are offered by a number of banks and insurance companies.

A Part-time Employment Service is provided to assist students in locating jobs both on and off campus. Students who desire part-time work should call at the Financial Aid Office when they arrive on the campus.

School of Agriculture



SCHOOL OF AGRICULTURE

H. B. James, Dean

E. W. Glazener, Director of Instruction

The agriculture of our modern world amounts to more than growing food and fiber. Agriculture 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 are all 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.

The new concept of agriculture is defined to include three important groups in our economy. The first is the farmers themselves. The people 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 College 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 State College has a large collection of scientific books and periodicals which provides excellent source material for many courses. In addition, students may draw from the specialized periodicals and textbooks located in the department libraries.

State College's 17 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 providing student members a chance to travel while learning more about their field.

Curricular Offerings and Requirements—The modern concept of agriculture has given 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 34 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 listing below), depending on the curriculum. The student also will 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 interest and objectives.

The majors offered in the three curricula are as follows:

Agricultural Business—Agricultural economics, animal husbandry, dairy manufacturing, dairy husbandry, field crops, horticulture, poultry science, and soils.

Agricultural Science—Agricultural economics, agricultural engineering (joint program with the School of Engineering), animal husbandry, botany, dairy manufacturing, dairy husbandry, entomology, field crops, horticulture, poultry science, rural sociology, soils, wildlife biology, and zoology. Pre-veterinary work also is taken in this curriculum.

Agricultural Technology—Agricultural economics, agricultural engineering, animal husbandry, field crops, horticulture, plant protection, poultry science, and 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 resident.

The Doctor of Philosophy degree is offered by the following departments: Agricultural Economics, Agricultural Engineering, Animal Industry, 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 fields of agriculture are as follows:

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—more than 500 of them—are available to a graduate in agriculture. There are many opportunities in tech-

nology, science, and business. The School of Agriculture stands ready to help meet the challenge of the new concept of agriculture with forward-looking curricula.

The departments in the School of Agriculture have a common freshman year with the exception of the Department of Agricultural Engineering. For the agricultural engineering freshman year see section on agricultural engineering.

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
AG 103, Introduction to Agriculture	1	ENG 112, Composition	3
ENG 111, Composition	3	MA 112, Analytic Geometry and Calculus	
MA 111, Algebra and Trigonometry		or	
or		MA 102, Analytic Geometry and Calculus	4
MA 101, Algebra and Trigonometry	4-5	PS 201, American Governmental System	3
HI 261, U. S. in Western Civilization	3	ZO 103, General Zoology	4
BO 103, General Botany	4	PE 102, Physical Education	1
PE 101, Physical Education	1	MS 102, Military Science	
MS 101, Military Science		or	
or		AS 122, Air Science	1
AS 121, Air Science	1		16
	17-18		

AGRICULTURAL BUSINESS CURRICULUM

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 231, Basic Speaking Skills	3	ML, Modern Language Elective	
CH 101, General Inorganic Chemistry	4	or	
PSY 200, Introduction to Psychology	3	ENG, English Elective	3
RS 301, Sociology of Rural Life	3	AGC 212, Economics of Agriculture	3
EC 201, Economics	3	PY 221, College Physics	5
PE 201, Physical Education	1	Group D Elective	3
MS 201, Military Science		PE 202, Physical Education	1
or		MS 202, Military Science	
AS 221, Air Science	1	or	
	18	AS 222, Air Science	1
			16

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
Group B Electives	6	Group B Electives	6
Group A or C Elective	3	Departmental Requirement	6
Departmental Requirement	6	Free Elective	3
Free Elective	3		15
	18		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
Group B Electives	6	Group B Electives	6
Group A or C Elective	2	Departmental Requirement	7
Departmental Requirement	7	Free Elective	3
Free Elective	3		16
	18		

AGRICULTURAL SCIENCE CURRICULUM

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ML Modern Language Elective or		ML, Modern Language Elective or	
ENG, English Elective	3	ENG, English Elective	3
CH 101, General Inorganic Chemistry or		CH 103, General and Qualitative Chemistry or	
CH 201, General Inorganic Chemistry	4-5	CH 203, General and Organic Chemistry	4
PY 211, General Physics*	4	PY 212, General Physics*	4
Group D Elective	3	Group D Elective	3
PE 201, Physical Education	1	PE 202, Physical Education	1
MS 201, Military Science or		MS 202, Military Science or	
AS 221, Air Science	1	AS 222, Air Science	1
	16-17		16

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
Group A Elective	5	Group A, B, or C Elective	3
Group D Elective	3	Group D Elective	3
Departmental Requirement	6	Departmental Requirement	7
Free Elective	3	Free Elective	3
	17		16

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
Group A Elective	4	Group A Elective	6
Group A, B, or C Elective	3	Group D Elective	3
Departmental Requirement	7	Departmental Requirement	6
Free Elective	3	Free Elective	3
	17		18

**Physics 221 substituted for 211-212 in some agricultural programs.*

AGRICULTURAL TECHNOLOGY CURRICULUM

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 231, Basic Speaking Skills	3	SOI 200, Soils	4
CH 101, General Inorganic Chemistry	4	CH 103, General and Qualitative Chemistry or	
PY 221, General Physics	5	CH 203, General and Organic Chemistry	4
EC 201, Economics	3	AGC 212, Economics of Agriculture	3
PE 201, Physical Education	1	RS 301, Sociology of Rural Life	3
MS 201, Military Science or		PE 202, Physical Education	1
AS 221, Air Science	1	MS 202, Military Science or	
	17	AS 222, Air Science	1
			16

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
Modern Language Elective or		Group A Elective	3
English Elective	3	Group D Elective	3
Group D Elective	3	Departmental Requirement	7
Departmental Requirement	6	Free Elective	3
Group C Elective	3		16
Free Elective	3		
	18		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
Group A or B Elective	5	Group C Elective	6
Group C Elective	3	Departmental Requirement	7
Departmental Requirement	7	Free Elective	3
Free Elective	3		16
	18		

CREDITS REQUIRED FOR GRADUATION

	Agricultural Business	*Agricultural Science*	*Agricultural Technology*
Language	12	12	12
Social Science and Humanities (Group D*)	21	21	21
Physical and Biological Sciences	25	28	33
Restricted Electives:			
Group B	24	Group A** 26	Group A, B 9-11
Group A and C	5		Group C 9-12
Introduction to Agriculture	1	Introduction to Agriculture 1	Introduction to Agriculture 1
Departmental Requirements	26	26	27
Free Electives	12	12	12
	126	126	126
Physical Education PE 101, 102, 201, 202	4	4	4
Military Science I and II MS 101, 102, 201, 202 or Air Science I and II AS 121, 122, 221, 222	4	4	4

GROUP ELECTIVES

GROUP A

Physical Sciences

Chemistry

CH 103	General and Qualitative Chemistry
CH 203	General and Organic Chemistry
CH 205	General and Qualitative Chemistry
CH 211, 212, 215	Quantitative Analysis
	All courses at 400 level and above

Geology

MIG 120	Physical Geology
MIG 222	Historical Geology
MIG 323	Paleontology
MIG 330	Mineralogy
MIG 442	Petrology

Mathematics

MA 201	Analytic Geometry and Calculus II
MA 202	Analytic Geometry and Calculus III
MA 211, 212	Analytic Geometry and Calculus B, C
MA 215	Finite Mathematics
	All courses at 400 level and above

Physics

PY 202 or 212	General Physics
PY 223	Astronomy and Astrophysics
	All courses at 300 level and above

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

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

Soils

SOI 200	Soils
SOI 302	Soils and Plant Growth
SOI 452	Soil Classification
SOI 511	Soil Physics
SOI 521	Soil Chemistry
SOI 551	Soil Morphology, Genesis and Classification

Statistics

ST 302	Statistical Laboratory
ST 311	Introduction to Statistics
ST 361, 362	Introduction to Statistics for Engineers I, II
	All courses at 500 level

Biological Sciences

Agricultural Engineering

AGE 303	Energy Conversion for Agricultural Production

Animal Industry

AI 312	Principles of Livestock Nutrition
AI 501	Physiology of Domestic Animals
AI 502	Reproduction and Lactation

Bacteriology

BO 312	General Bacteriology

Botany

BO 211, 212	Dendrology
BO 403	Systematic Botany
BO 410	Plant Histology and Microtechnique
BO 421	Plant Physiology
BO 441	Plant Ecology
	All courses at 500 level

Dairy Manufacturing

DM 407	Dairy Bacteriology I
DM 506	Dairy Bacteriology II
DM 508	Dairy Chemistry

Entomology

ENT 301	Introduction to Forest Insects
ENT 312	Economic Enotomology
	All courses at 500 level

Genetics

GN 301	Genetics in Human Affairs
GN 411	Principles of Genetics
GN 512	Genetics
GN 513	Cytogenetics I

Plant Pathology

PP 315	Plant Diseases
PP 318	Diseases of Forest Trees
PP 500	Advanced Plant Pathology
PP 501A	Advanced Plant Pathology Lab, Field Crop Diseases
PP 501B	Advanced Plant Pathology Lab, Horticulture Crop Diseases

Poultry

PO 401	Poultry Diseases
PO 521	Poultry Nutrition
PO 522	Endocrinology of the Fowl

Zoology

ZO 212	Human Anatomy
ZO 213	Human Physiology
ZO 223	Comparative Anatomy
ZO 252	Ornithology
ZO 301	Animal Physiology
ZO 315	Animal Parasitology
ZO 452	Animal Microtechnique
	All courses at 500 level except ZO 521, 551 and 552 which appear in Group C.

Other courses in the Physical and Biological Sciences not presently listed may be elected upon approval of the Director of Instruction.

GROUP B

Economics and Business Management

Students in the agricultural business curriculum are to choose certain of their courses from very restricted lists, in order that fundamental grounding in each area be assured. Specifically, one course is to be taken from Group 1, one course from Group 2, and two courses from Group 3. Courses in these groups also appear in the broader and more inclusive lists, Group 4 and Group 5. Three courses are to be taken from Group 4 and one course from Group 5 which were not elected from Groups 1, 2 and 3.

Group 1

EC 312	Accounting for Engineers
EC 407	Business Law I
EC 425	Industrial Management

Group 2

AGC 303	Farm Management I
AGC 311	Marketing Agricultural Products (or equiv.)
AGC 413	Farm Appraisal and Finance
AGC 521	Economics of Agricultural Marketing
AGC 523	Farm Management II

Group 3

AGC 431	Introduction to Agricultural Prices
AGC 533	Agricultural Policy
AGC 551	Agricultural Production Economics
AGC 552	Consumption, Distribution and Prices in Agriculture
EC 302	National Income and Economic Welfare
EC 310	Economics of the Firm
EC 442	Economic Forecasting

Group 4

	All courses listed in Group 1 or Group 2
AGC 322	Organization and Management of Cooperatives
EC 315	Salesmanship
EC 401, 402	Principles of Accounting
EC 408	Business Law II
EC 409	Introduction to Production Costs
EC 411	Marketing Methods
EC 412	Sales Management
EC 414	Tax Accounting
EC 415	Advertising
EC 420	Corporation Finance
EC 426	Personnel Management
EC 431	Labor Problems
EC 432	Industrial Relations
EC 504, 505	Principles of Cost Accounting
EC 515	Investments
EC 525	Management Policy and Decision Making

Group 5

	All courses listed in Group 3
EC 410	Industry Studies
EC 413	Competition, Monopoly, and Public Policy
EC 440	Economics of Growth
EC 448	International Economics
EC 450	Economic Decision Processes
EC 455	Econometrics

GROUP C

Applied Science and Technology

Agriculture

AG 301	Agencies and Programs for Agriculture
AG 401	Principles and Methods of Extension Education

Agricultural Engineering

AGE 201	Farm Shop Woodwork
AGE 202	Farm Shop Metalwork
AGE 211	Farm Power & Machinery I
AGE 321	Irrigation, Drainage and Terracing
AGE 332	Farm Bldg. and Crop Processing
AGE 341	Farm Electrification and Utilities

Animal Industry

AI 201	Elem. Dairy Science
AI 202	Fundamentals of Animal Husbandry
AI 301	Grading and Selecting Meat Animals
AI 303	Meat and Meat Products
AI 307	Advanced Selection & Evaluation of Livestock
AI 309	Meat Selection
AI 404	Dairy Farm Problems
AI 407	Advanced Livestock Production
AI 503	Animal Breeding
AI 505	Diseases of Farm Animals

Dairy Manufacturing

DM 401	Mktg. Milk and Related Products
DM 400	Plant Experience

Entomology

ENT 322	Beekeeping

Field Crops

FC 211	Field Crops I
FC 311	Field Crops II
FC 312	Pastures and Forage Crops
FC 412	Advanced Pastures and Forage Crops
FC 413	Plant Breeding
FC 414	Weeds and Their Control
FC 511	Tobacco Technology

Horticulture

HRT 201	Principles of Horticulture
HRT 301	Plant Propagation
HRT 342	Landscape Gardening
HRT 351	Greenhouse Management
HRT 421	Fruit Production
HRT 432	Vegetable Production
HRT 441, 442	Floriculture
HRT 471	Arboriculture
HRT 481	Breeding of Horticulture Plants

Poultry

PO 201	Poultry Production
PO 301	Poultry Quality Evaluation
PO 351	Poultry Grading
PO 402	Commercial Poultry Enterprises
PO 404	Poultry Products
PO 520	Poultry Breeding

Soils

SOI 341	Soil Fertility and Fertilizers
SOI 461	Soil Conservation and Management

Zoology

ZO 312	Principles of Game Management
ZO 321	Wildlife and Natural Resource Conservation
ZO 521	Fishery Biology
ZO 551, 552	Wildlife Management

GROUP C ELECTIVES IN OTHER SCHOOLS

Engineering

EM 341	Mechanics A (Statics)
EM 342	Mechanics B (Dynamics)
EM 343	Strength of Materials A
EE 341	Industrial Electricity
IE 334	Motion and Time Study
MIM 321	Metallurgy

Forestry

FOR 311	Principles of Farm Forestry
FOR 402	Foundations of Forest Management

Psychology

PSY 337	Industrial Psychology I

Other courses in the Applied Science and Technology not presently listed may be elected upon approval of the Director of Instruction.

GROUP D

Social Science and Humanities

Agricultural Economics

AGC 212	Economics of Agriculture
AGC 501	Intermediate Agricultural Economics Theory
AGC 512	Land Economics

Economics

EC 201, 202	Economics
EC 436	Economic Fluctuations
EC 442	Evolution of Economic Ideas
EC 444	Economic Systems
EC 501	Intermediate Economic Theory
EC 502	Money, Income and Employment
EC 510	Public Finance
EC 514	International Economics
EC 519	Monetary Theory
EC 540	Economic Growth and Development
EC 548	Economics of Welfare
EC 550	Mathematical Models in Economics
EC 555	Introduction to Linear Programming

History

HI 201	The Ancient World
HI 202	The Medieval World
HI 205	The Modern Western World
HI 225, 226	Modern Europe
HI 251	The United States to 1865
HI 252	The United States since 1865
HI 261	The United States in Western Civilization
	All courses at 300 level and above

Political Science

PS 201	The American Governmental System
PS 202	County and Municipal Government
PS 301	Comparative Political Systems
PS 302	Contemporary World Politics
	All courses at 400 level and above

Philosophy and Religion

PHI 201	Logic
PHI 203	Effective Living
PHI 205	Problems and Types of Philosophy
REL 301	Religious Groups and Trends in the United States
REL 302	The Bible and Its Background
REL 303	Christian Ethics
PHI 305	Philosophy of Religion
PHI 306	Philosophy of Art
PHI 309	Marriage and Family Living
PHI 311	Parent-Child Relationships
PHI 395	Philosophical Analysis
	All courses at 400 level and above

Psychology

PSY 200	Introduction to Psychology
PSY 201	Elementary Experimental Psychology
PSY 302	Psychology of Personality and Adjustment
PSY 304	Educational Psychology
PSY 307	General Applied Psychology
	All courses at 400 level and above including:
PSY 476	Psychology of Adolescence
PSY 490	Social Psychology
PSY 511	Advanced Social Psychology
PSY 565	Industrial Management Psychology

Rural Sociology

RS 301	Sociology of Rural Life
RS 321	Introduction to Social Research
RS 322	Introduction to Rural Social Work
RS 441	Rural Social Pathology
RS 442	Rural Social Structure

Sociology and Anthropology

ANT 205	People of the World
ANT 251	The Study of Man
ANT 252	Cultural Anthropology
SOC 111, 112	The American Way of Life
SOC 202	Man and Society (General Sociology)
SOC 301	Human Behavior
SOC 302	Public Relations and Modern Society
SOC 303	Current Social Problems
SOC 304	Contemporary Family Life
SOC 305	Race Relations
SOC 306	Delinquency and Crime
	All courses at 400 level and above

Social Studies

SS 301, 302	Contemporary Civilization
SS 491, 492	Contemporary Issues

Other courses in the Social Sciences and Humanities not presently listed my be elected upon approval of the Director of Instruction.

AGRICULTURAL ECONOMICS

Professor C. E. Bishop, *Head of the Department*
Professors H. Brooks James, Richard A. King, James G. Maddox, Walter H. Pierce, George S. Tolley, William D. Toussaint
Associate Professors Arthur Coutu, William R. Henry, Quentin W. Lindsey, James A. Seagraves, Anthony P. Stemberger, James C. Williamson, Jr.
Assistant Professors Dale M. Hoover, Loren A. Ihnen, Richard L. Simmons, John F. Stallsteimer, T. Dudley Wallace
Instructors R. Charles Brooks, Garnett L. Bradford, Adger B. Carroll, Walter L. Fishel, Robert M. Ray, T. Kelley White, Jr.

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

Three options are available to undergraduate students majoring in agricultural economics. These options include agricultural business, agricultural science, and agricultural technology. Students are given training in all aspects of organizing and operating agricultural business firms. A sound foundation in basic economic principles in production and marketing is provided in order that graduates will be able to deal with problems associated with the rapid changes in technical and economic conditions.

The general objectives of the department are as follows:

(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.

(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 other 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 various credit agencies.

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

Facilities—The department has a modern and well equipped library, including all of the major professional journals and USDA publications. Experiment station publications from other institutions throughout the United States are kept on file. Modern computational and reproduction equipment is available. In addition, the department has access to cooperative use of IBM equipment in the Department of Experimental Statistics, including a 650 digital computer and a Rand 1105 computer. The department is housed in Patterson Hall.

Undergraduate Curriculum—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. In addition, students must meet all of the basic requirements of the college and the School of Agriculture.

Agricultural Business—The requirements for the agricultural business curriculum are as follows:

GROUP B COURSES (24 Credits)

	Credits
AGC 311, Organization and Business Management of Marketing Firms	3
AGC 551, Agricultural Production Economics	3
AGC 552, Consumption, Distribution and Prices In Agriculture	3
EC 302, National Income and Economic Welfare	3
EC 312, Accounting for Engineers	
or	
EC 401, Principles of Accounting	3
EC 407, Business Law I	3
Electives	6

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, Organization and Business Management of Farms	3
ST 311, Introduction to Statistics	3
AGC 533, Agricultural Policy	3
AGC 521, Procurement, Processing and Distribution of Agricultural Products	
or	
AGC 523, Planning Farm and Area Adjustments	3
Electives	14

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

GROUP A COURSES (26 Credits)

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

DEPARTMENTAL REQUIREMENTS AND ELECTIVES (26 Credits)

	Credits
AGC 303, Organization and Business Management of Farms	3
AGC 311, Organization and Business Management of Marketing Firms (or equivalent)	3
AGC 533, Agricultural Policy	3
AGC 551, Agricultural Production Economics	3
AGC 552, Consumption, Distribution, and Prices in Agriculture	3
ST 311, Introduction to Statistics	3
EC 312, Accounting for Engineers or EC 401, Principles of Accounting	3
Electives	5

Agricultural Technology—The requirements of the agricultural technology curriculum are as follows:

GROUP A AND B COURSES (9-12 Credits)

	Credits
AGC 521, Procurement, Processing and Distribution of Agricultural Products or AGC 523, Planning Farm and Area Adjustments	3
Electives	6-9

GROUP C COURSES (9-12 Credits)

Electives	9-12

DEPARTMENTAL REQUIREMENTS AND ELECTIVES (26 Credits)

AGC 303, Organization and Business Management of Farms	3
AGC 311, Organization and Business Management of Marketing Firms (or equivalent)	3
AGC 533, Agricultural Policy	3
AGC 551, Agricultural Production Economics	3
AGC 552, Consumption, Distribution, and Prices in Agriculture	3
ST 311, Introduction to Statistics	3
EC 312, Accounting for Engineers or EC 401, Principles of Accounting	3
Electives	5

Graduate Study—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

Professor F. J. Hassler, *Head of the Department*
Professors J. M. Fore, G. Wallace Giles*, David S. Weaver, John W. Weaver, Jr.
Associate Professors H. D. Bowen, Ezra L. Howell, Jan van Schilfgaarde, W. E. Splinter
Assistant Professors George B. Blum, Jr., K. A. Jordan, C. W. Suggs
Instructors E. O. Beasley, J. F. Beeman, Thomas H. Garner, W. H. Johnson, J. I. Sewell, R. W. Watkins, Edward H. Wiser, F. Scott Wright
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.

The Department of Agricultural Engineering is housed in the Agricultural Engineering Building.

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, and so forth; as county agents or farmers; and for farm advisory work with such organizations as electric power companies.

Undergraduate Curriculum—*Agricultural Science*—This curriculum, offered in conjunction with the School 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 judgment to engineering situations in agricultural operations. General agriculture courses are provided in order that the student can better understand the agricultural industry with which he deals.

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*On leave 1961

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, Algebra and Trigonometry; Analytic Geometry and Calculus I	9
AG 103, 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	2
PE 101, 102, Physical Education	2
	32

SOPHOMORE

	Credits
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, Analytic Geometry and Calculus II and III	8
PY 201, 202, General Physics	10
MS 201, 202, Military Science	
or	
AS 221, 222, Air Science	2
PE 201, 202, Physical Education	2
	35

JUNIOR

	Credits
BO 103, General Botany	4
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 301, Differential Equations	3
SOI 200, Soils	4
English Elective	3
Electives	6
	41

SENIOR

	Credits
HI 261, The United States in Western Civilization	3
AGC 212, Economics of Agriculture	3
or	
AGC 551, Agricultural Production Economics	
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
	41

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

Agricultural Engineering Technology—This curriculum 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 research engineer. The courses are presented and directed toward the solution of consumer problems with emphasis on the techniques employed. The requirements of the agricultural engineering technology curriculum are as follows:

Freshman year is the same as listed above in agricultural science curriculum.

GROUP A AND B COURSES (11 Credits)

	Credits
MA 201, Analytic Geometry and Calculus II	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, Algebra and Trigonometry; Analytic Geometry and Calculus I
CH 203, General and Organic Chemistry

Graduate Study—The Department of Agricultural Engineering offers advanced study leading to the Doctor of Philosophy 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 interested primarily in existing technology, a program of study for the Master of Agricultural Engineering degree permits selections from a variety of advanced 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 Doctor of Philosophy degree.

ANIMAL INDUSTRY

Professor George Hyatt, Jr., *Head of the Department*
Professors L. W. Aurand, E. R. Barrick, E. G. Batte, T. N. Blumer, J. L. Etchells, F. M. Haig, J. E. Legates, Gennard Matrone, W. R. Murley, J. C. Osborne, W. M. Roberts, M. L. Speck, H. A. Stewart, W. E. Thomas, S. B. Tove, L. C. Ulberg, G. H. Wise
Associate Professors T. A. Bell, E. U. Dillard, Lemuel Goode, J. G. Leece, H. A. Ramsey, R. B. Redfern, F. H. Smith, F. G. Warren
Assistant Professors A. J. Clawson, J. P. Everett, J. J. McNeill, R. D. Mochrie, J. L. Moore, R. M. Myers, O. W. Robinson, W. W. G. Smart, Jr., M. B. Wise
Instructors C. W. Alliston, H. B. Craig, C. W. Dill, G. L. Ellis, J. H. Gregory, J. M. Leatherwood, J. W. Smith, D. G. Spruill

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 in the near future, an undergraduate program for a major in animal nutrition in the agricultural science curriculum.

The Department of Animal Industry is housed in Polk Hall.

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 as follows:

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 pro-

ducts, government (state or federal) inspection and control of dairy products and research and development.

Undergraduate Curriculum—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—The requirements of the agricultural business curriculum are as follows:

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—The requirements of the agricultural science curriculum are as follows:

GROUP A COURSES (26 Credits)

	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)

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 (GN 503), Genetic Improvement of Livestock	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—The requirements of the agricultural technology curriculum are as follows:

GROUP A AND B COURSES (10 Credits)

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

GROUP C COURSES (11 Credits)

	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, (GN 503), Genetic Improvement of Livestock	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 Curriculum—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—The requirements of the agricultural business curriculum are as follows:

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, Introductory Biochemistry	3
AI 502, Reproduction and Lactation	4

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

GROUP A COURSES (26 Credits)

	Credits
ZO 301, Animal Physiology	3
CH 451, Introductory 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	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 (GN 503), Genetic Improvement of Livestock	3
Elective	2

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

Agricultural Technology—The requirements of the agricultural technology curriculum are as follows:

GROUP A AND B COURSES (9-12 Credits)

	Credits
ZO 301, Animal Physiology	3
CH 451, Introductory 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)

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, (GN 503), Genetic Improvement of Livestock	3
Electives	3

Undergraduate Curriculum—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—The requirements of the agricultural business curriculum are as follows:

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—The requirements of the agricultural science curriculum are as follows:

GROUP A COURSES (26 Credits)

	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—The requirements of the agricultural technology curriculum are as follows:

GROUP A AND B COURSES (11 Credits)

	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 Study—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.

AGRONOMY

See Field Crops and Soils

BOTANY AND BACTERIOLOGY

Professor H. T. Scofield, *Head of the Department*
Professors E. A. Ball, H. J. Evans, J. B. Evans, L. A. Whitford
Associate Professor E. O. Beal
Assistant Professors 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 also is 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 Master of Science and Doctor of Philosophy degrees in one of the 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.

Undergraduate Curriculum—Botany—The Bachelor of Science degree with a major in the agricultural science curriculum from the School of Agriculture can be obtained in botany. The general requirements of the agricultural science curriculum are as follows:

	Credits
PHYSICAL AND BIOLOGICAL SCIENCES	
CH 203, General and Organic Chemistry	4
GROUP A COURSES	
*Electives	26
DEPARTMENTAL REQUIREMENTS AND ELECTIVES	
BO 301, General Morphology	3
BO 403, Systematic Botany	3
BO 421, Plant Physiology	4
BO 441, Plant Ecology	3
GN 411, Principles of Genetics	3
PP 315 or 318, Plant Diseases, Disease of Forest Trees	3
BO 312, General Bacteriology	4
Elective	3

Undergraduate Curriculum—Bacteriology—The department does not offer and undergraduate major program in bacteriology.

Graduate Study—Botany and bacteriology offer 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, systematic botany, bacteriology and morphology.

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

DAIRY HUSBANDRY

See Animal Industry

DAIRY MANUFACTURING

See Animal Industry

ENTOMOLOGY

Professor Clyde F. Smith, *Head of the Department*
Professor T. B. Mitchell
Associate Professors C. H. Brett, F. E. Guthrie, F. R. Lawson, W. J. Mistric, R. L. Rabb, D. A. Young, Jr.
Assistant Professors W. V. Campbell, M. H. Farrier, R. T. Gast, H. H. Neunzig, W. A. Stephen
Instructor H. B. Moore

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

The Department of Entomology is housed in Gardner Hall.

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. One can go into business for himself as a pest control operator or an insecticide formulator.

Undergraduate Curriculum—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—The requirements of the agricultural science curriculum are as follows:

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
Advised electives	14

Agrciultural Technology—The Departments of Field Crops, Entomology, and Plant Pathology offer a joint major in plant protection. See section on plant protection for details.

Graduate Study—The Master of Science and Doctor of Philosophy degrees are offered in entomology. The work in entomology is well supported by strong Departments in Chemistry, Statistics, and the Plant and Animal Sciences.

FIELD CROPS

Professor P. H. Harvey, *Head of the Department*
Professors T. G. Bowery, D. S. Chamblee, D. U. Gerstel, W. C. Gregory, K. R. Keller, G. C. Klingman, R. L. Lovvorn, T. J. Mann, G. K. Middleton, P. A. Miller, R. P. Moore, J. C. Rice, J. A. Weybrew
Associate Professors C. A. Brim, G. L. Jones, L. L. Phillips, Luther Shaw, D. L. Thompson, R. P. Upchurch.
Assistant Professors W. A. Cope, J. W. Dudley, D. A. Emery, W. T. Fike, P. E. Gatterdam, W. B. Gilbert, H. D. Gross, G. R. Gwynn, R. H. Hamilton, J. A. Lee, W. M. Lewis, F. W. McLaughlin, J. R. Mauney, D. E. Moreland, C. F. Murphy, J. C. Williams
Instructors A. J. Crowley, J. L. Hall

Objectives—The curriculum in field crop has as its objectives 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 the state 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

*May be taken from Groups B and C.

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.

The Department of Field Crops is housed in Williams Hall.

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.

Undergraduate Curriculum—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—The requirements of the agricultural business curriculum are as follows:

GROUP B COURSES (24 Credits)

	Credits
AGC 303, Organization and Business Management of Farms	3
or	
AGC 311, Organization and Business Management of Marketing Firms	
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 and Fertilizers	3

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

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, Analytic Geometry and Calculus I	
or	
MA 211, Analytic Geometry and Calculus B	3 or 4
*Electives	12 or 13

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

DEPARTMENTAL REQUIREMENTS AND ELECTIVES (26 Credits)

	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	4
SOI 302, Soils and Plant Growth	
or	
SOI 341, Soil Fertility and Fertilizers	3
Elective	3

Agricultural Technology—The requirements of the agrciultural technology curriculum are as follows:

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
Electives	2

The Departments of Field Crops, Entomology, and Plant Pathology offer a joint major in plant protection. See section on plant protection for details.

Graduate Study—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

Professor H. F. Robinson, *Head of the Department*
Professors C. H. Bostian, D. S. Grosh, Ben W. Smith, S. G. Stephens
Associate Professor D. F. Matzinger
Assistant Professors T. M. Kelleher, Ken-ichi Kojima, L. E. Mettler, R. H. Moll
Cooperating with the following associate members of the faculty:
Animal Industry—D. U. Dillard, J. E. Legates, O. W. Robison, 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. Emery, 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, G. J. Galletta, 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—T. O. Perry, B. J. Zobel
Statistics—C. Clark Cockerham

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.

The Department of Genetics is housed in Gardner Hall.

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

Graduate Study—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

Professor Fred D. Cochran, *Head of the Department*
Professors J. L. Etchells, M. E. Gardner, J. H. Harris, F. L. Haynes, Jr., J. M. Jenkins, Jr., I. D. Jones, G. O. Randall, C. F. Williams
Associate Professors W. E. Ballinger, C. L. McCombs, M. W. Hoover, D. T. Pope
Assistant Professors T. F. Cannon, F. E. Correll, G. J. Galletta, W. R. Henderson, C. H. Miller, R. J. Schramm, Jr.
Instructors T. R. Konsler, 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, marketing and utilization of fruit, vegetable and ornamental crops, and also to the processing 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, improvement of handling and marketing methods, and development of the food processing industry.

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.

Undergraduate Curriculum—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—The requirements of the agricultural business curriculum are as follows 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

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 451	Principles of Fruit and Vegetable Processing	3
	Electives	6
	or	

Six courses in Ornamental Crops

		Credits
HRT 211, 212	Ornamental Plants	6
HRT 301	Plant Propagation	3
HRT 351, 441, 442	Greenhouse Management; Floriculture	
or		
HRT 342, 411, 471	Landscape Gardening; Nursery Management; Arboriculture	9

Agricultural Science—The requirements of the agricultural science curriculum are as follows for specialization in fruit and vegetable crops and 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

Four courses in Fruit and Vegetable Crops

HRT 421	Fruit Production	3
HRT 432	Vegetable Production	3
HRT 451	Principles of Fruit and Vegetable Processing	3
HRT 562	Post-Harvest Physiology	3
	Electives	8
	or	

Four courses in Ornamental Crops

HRT 211, 212	Ornamental Plants	6
HRT 441, 442	Floriculture	
or		
HRT 411, 471	Nursery Management; Arboriculture	6
	Electives	8

Agricultural Technology—The requirements of the agricultural technology curriculum are as follows for specialization in fruit and vegetable crops and ornamental crops:

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)

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

DEPARTMENTAL REQUIREMENTS AND ELECTIVES (27 Credits)

		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 451	Principles of Fruit and Vegetable Processing	3
HRT 562	Post-Harvest Physiology	3
	or	

Six courses in Ornamental Crops

HRT 211, 212	Ornamental Plants	6
HRT 301	Plant Propagation	3
HRT 351, 441, 442	Greenhouse Management; Floriculture I and II	
or		
HRT 342, 411, 471	Landscape Gardening; Nursery Management; Arboriculture	9

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)

AGE 331	Power, Heating and Refrigeration	3
HRT 201	Principles of 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 451	Principles of Fruit and Vegetable Processing	3
HRT 462	Grading Processed Fruits and Vegetables	2
HRT 562	Post-Harvest Physiology	3
	Electives	6

Graduate Study—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 Master of Science degree places emphasis on research and provides a basis for later study on the Doctor of Philosophy degree.

PLANT PATHOLOGY

Professor D. E. Ellis, *Head of the Department*
Professors C. N. Clayton, F. A. Haasis, T. T. Herbert, A. Kelman, E. L. Moore, L. W. Nielsen, C. J. Nusbaum
Associate Professors J. L. Apple, Robert Aycock, G. B. Lucas, R. R. Nelson, L. H. Person, J. N. Sasser, N. N. Winstead
Assistant Professors W. E. Cooper, Hedwig Triantaphyllou, C. S. Hodges, D. M. Kline, N. T. Powell, J. P. Ross, R. T. Sherwood, D. L. Strider

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.

Undergraduate Curriculum—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 Study—The Department of Plant Pathology offers graduate training in all phases of plant pathology leading to the degree of Master of Science and Doctor of Philosophy.

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 products 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

Bachelor of Science degree. However, qualified students can go on to graduate school from this curriculum.

Undergraduate Curriculum—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—The requirements of the agricultural technology curriculum are as follows:

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 201, Principles of 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

Professor H. W. Garren, *Head of the Department*
Professors C. W. Barber, E. W. Glazener, C. H. Hill
Associate Professors T. T. Brown, F. R. Craig, D. Fromm, J. W. Kelly
Assistant Professors W. L. Blow, H. L. Bumgardner, F. W. Cook, 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.

The Department of Poultry Science is housed in Scott Hall.

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 businesses.

Undergraduate Curriculum—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—The requirements of the agricultural business curriculum are as follows:

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—The requirements of the agricultural science curriculum are as follows:

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

Agricultural Technology—The requirements of the agricultural technology curriculum are as follows:

GROUP A AND B COURSES (11 Credits)

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

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

GROUP C COURSES (10 Credits)

	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 520, Poultry Breeding	3
PO 521, Poultry Nutrition	3
Electives	2

Graduate Study—The Master of Science 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 Master of Science 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 three 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 Bachelor of Science degree from State College 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 these students who complete the required courses successfully (grade 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)

	Credits
HI 261, The U. S. in Western Civilization	3
PS 201, American Government System	3

PHYSICAL AND BIOLOGICAL SCIENCES (36 Credits)

	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

Professor Selz C. Mayo, *Head of the Department*
Professor C. Horace Hamilton
Associate Professor Glenn C. McCann
Assistant Professor 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.

The Department of Rural Sociology is housed in the 1911 Building.

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

Undergraduate Curriculum—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—The requirements of the agricultural science curriculum are as follows:

GROUP A COURSES (26 Credits)

	Credits
ST 311, Introduction to Statistics	3
GN 411, Principles of Genetics	3
MIG 120, Physical Geology	3
*Electives	17

DEPARTMENTAL REQUIREMENTS AND ELECTIVES (26 Credits)

SOC 202, Principles of Sociology	3
RS 301, Sociology of Rural Life	3
SOC 301, Human Behavior	3
ANT 252, Cultural Anthropology	3
RS 321, Introduction to Social Research	3
RS 442, Rural Social Structure	3
Electives	8

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

Graduate Study—The Master of Science and the Doctor of Philosophy degrees are offered by this department. Graduate students studying for the Doctor of Philosophy 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 Master of Science 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

Professor J. W. Fitts, *Head of the Department*
Associate Professors S. E. Younts, *In Charge, Soils Teaching*
Professors W. V. Bartholomew, N. T. Coleman, J. F. Lutz, W. G. Woltz, W. W. Woodhouse, Jr.
Associate Professors Homer C. Folks, E. J. Kamprath, C. B. McCants, R. J. McCracken, A. Mehlich, J. R. Piland, W. H. Rankin, P. H. Reid, R. J. Volk, S. B. Weed
Assistant Professors E. F. Goldston, W. A. Jackson, R. E. McCollum
Instructors D. L. Craig, C. B. England, James Shelton, 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.

The Department of Soils is housed in Williams Hall.

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.

Undergraduate Curriculum—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—The requirements of the agricultural business curriculum are as follows:

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—The requirements of the agricultural science curriculum are as follows:

GROUP A COURSES (26 Credits)

	Credits
MA 201, Analytic Geometry and Calculus I	4
MA 202, Analytic Geometry and 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—The requirements of the agricultural technology curriculum are as follows:

GROUP A AND B COURSES (9-12 Credits)

	Credits
Electives	9-12

GROUP C COURSES (9-12 Credits)

	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 Study—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.

ZOOLOGY

Professor F. S. Barkalow, Jr., *Head of the Department*
Professors R. Harkema, T. L. Quay
Associate Professor W. W. Hassler
Assistant Professors C. W. Alliston, F. E. Hester, G. C. Miller, J. A. Santolucito
Instructors F. G. Gerlock, Jr., F. L. Roberts

Objectives—The Department of Zoology at North Carolina 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.

The Department of Zoology is housed in Gardner Hall.

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, Pure Food and Drug Administration, 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.

Undergraduate Curriculum—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—The requirements of the agricultural science curriculum are as follows:

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	2 or 3
One course in Entomology	3
One course in Chemistry	3
Electives (from Botany, Chemistry, Soils, Geology, Entomology, Genetics, Mathematics and/or Statistics)	2 or 4
*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 Curriculum—Zoology—The degree of Bachelor of Science with a major in zoology is offered under the agricultural science curriculum.

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

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
Restricted electives from Group A	12
Restricted electives from Groups A, B, and/or C	6

DEPARTMENTAL REQUIREMENTS AND ELECTIVES (26 Credits)

Advised electives (two courses must be in Zoology)	26

Graduate Study—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 NORTH CAROLINA AGRICULTURAL INSTITUTE

H. B. James, Dean of Agriculture

E. W. Glazener, Director of Instruction

Homer C. Folks, Assistant Director of Instruction and Director of the Agricultural Institute

A two year program in agriculture was approved and money was appropriated for this purpose by the 1959 General Assembly. Through action of the Board of Trustees of the Greater University, this two year program was named the North Carolina Agricultural Institute and was approved for operation on the North Carolina State College campus.

Objectives—The major objective of the Agricultural Institute is to provide technical training to the individual so that he may become more productive in our agricultural society. Specifically, instructions offered by the Agriculture Institute are designed to train men and women for those jobs in agriculture that require technicians with education beyond the high school level. By providing an individual with this type of training the Institute is convinced that he will have a better income, assume a more prominent role of leadership in his community, and become an asset to agriculture and to his community.

The instructional programs of the Agricultural Institute are organized and conducted as part of the School of Agriculture's over-all resident instruction program. The Institute is an addition to, and not a substitute for, the regular degree granting program of the School of Agriculture. However, in order to provide students enrolled in the Institute with the best possible technical training, the faculty in residence for the four year program will be responsible for organizing and teaching courses offered by the Institute.

People who have training similar to that which can be obtained in the courses offered in the Agricultural Institute are in great demand by agricultural industries. As this demand changes, new courses of study will be organized. Also, programs no longer needed will be dropped. Only through such a system of addition and deletion can the Agricultural Institute meet the needs for technically trained people in North Carolina.

Opportunities For Graduates—Rapid technical advancement has been extremely important in changing agriculture from a small production industry to one of the largest industries in the nation. Today the farmer uses scientifically developed seed, feed, fertilizer; does most of his work with machinery and has scientific testing to back up his management decisions. Increased production has allowed him to sell much of his production rather than just

the surplus above home consumption. Farms have become larger due to these technological advances and large amounts of capital are needed to operate successfully. All of these factors bring about dependence on outside sources of information and capital for success in a modern agricultural business.

Not only the person who farms, but the hundreds of related businesses that are a vital part of agriculture today can not operate successfully without men trained in technical skills.

Entrance Requirements—Any individual who has received a diploma from an accredited high school or has passed the high school equivalency examination administered by the State Department of Public Instruction is eligible for entry into the Agricultural Institute. Each application will be reviewed and evaluated by the Institute director before an applicant will be accepted.

Programs Of Study—The initial five programs of study offered are: Farm Machinery Sales and Service, General Agriculture, Livestock Management and Technology, Poultry Technology, and Pest Control.

THE AGRICULTURAL EXPERIMENT STATION

H. B. James, Dean of Agriculture

R. L. Lovvorn, Director of Research

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 19 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 economics 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

H. B. James, Dean of Agriculture

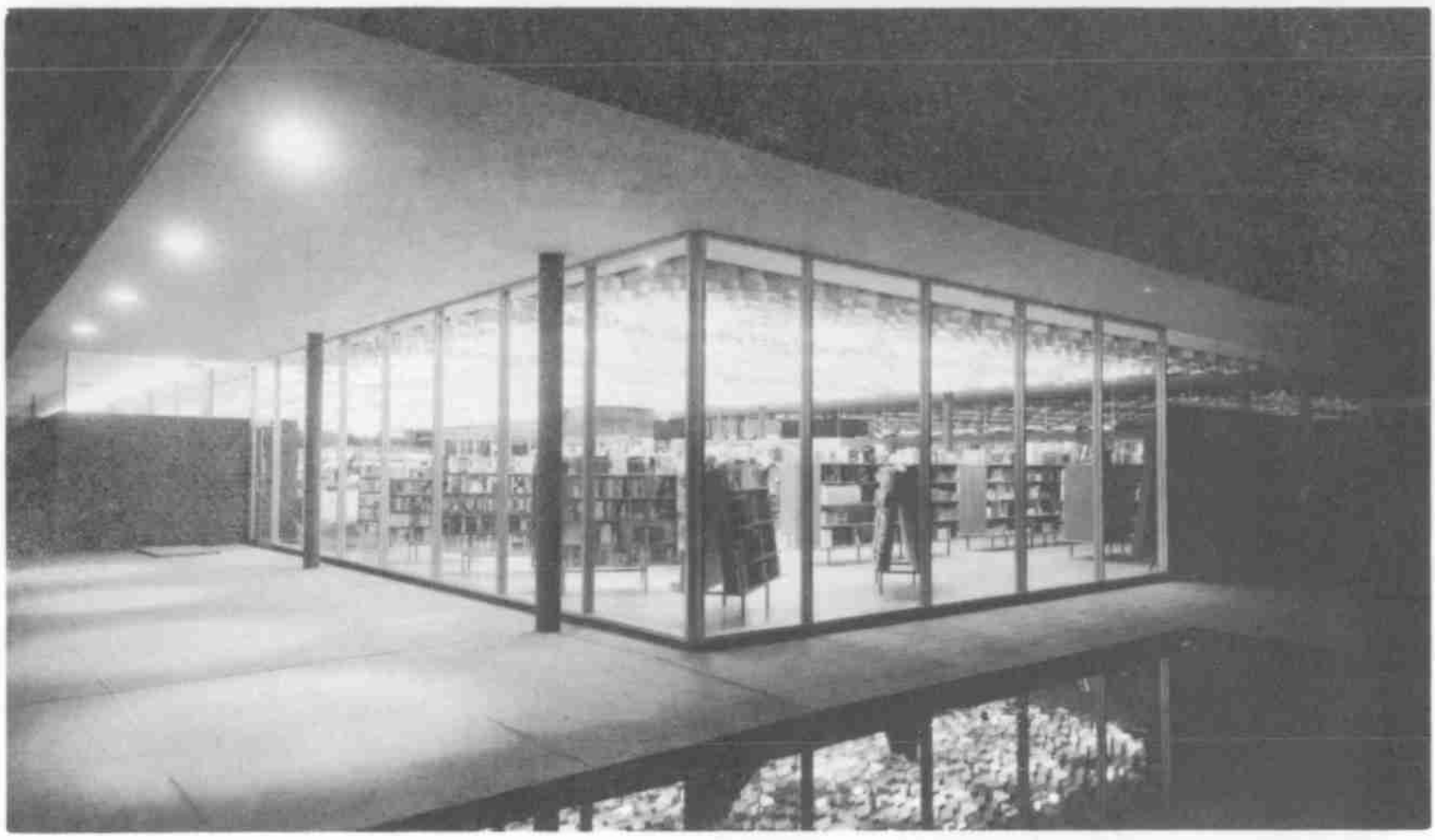
I. O. Schaub, Director Emeritus of Extension

David S. Weaver, Director of Extension

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 suported 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, a 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.

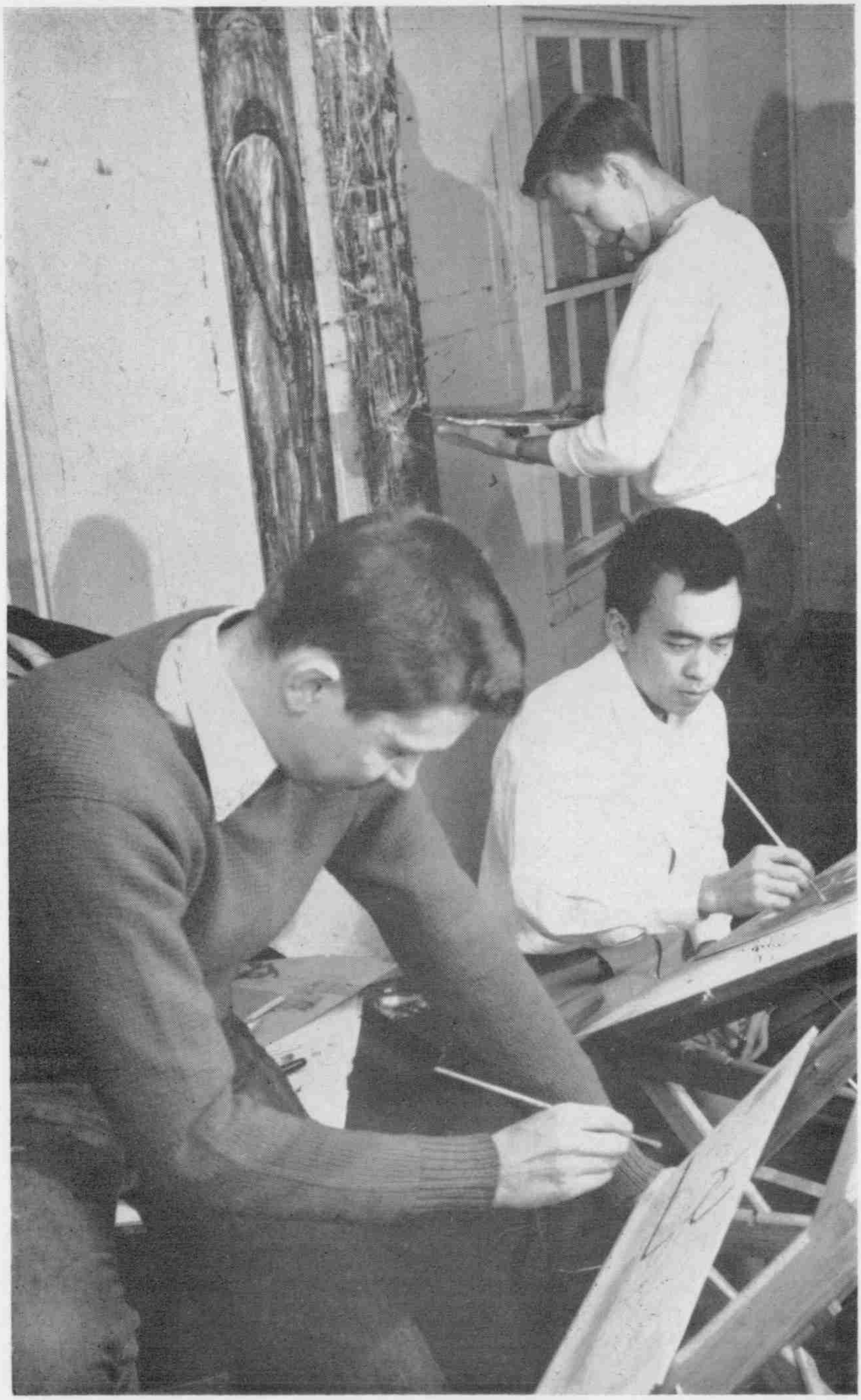


STUDENT SUPPLY Store is housed in a modern building which was completed late in 1959. With its equipment, the building is valued at $350,000. In addition to its excellent book department, the store also has departments featuring general student supplies, engineering equipment, and a fountain-snack bar.

Student Supply Store

STUDENTS browse in the book section of Student Supply Store.

School of Design



SCHOOL OF DESIGN

Henry L. Kamphoefner, Dean

In 1948 the School of Design was organized through the combination of the extisting Departments of Architecture and Landscape Acrhitecture. 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 human 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 members 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 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—The School of Design moved to Brooks Hall in January, 1956. 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 office 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. Three 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.

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, John Hertzman, John P. Shaw
Visiting Assistant Professors Paul M-J. Buisson, Brian Shawcroft
Librarian Mrs. James A. Lyons

CURRICULUM

FIRST YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 101, Design I	3	DN 102, Design II	3
DN 111, Descriptive Drawing I	2	DN 112, Descriptive Drawing II	2
DN 121, Technical Drawing I	3	DN 122, Technical Drawing II	3
ENG 111, Composition	3	ENG 112, Composition	3
MA 101, Algebra and Trigonometry	5	MA 102, Analytic Geometry and Calculus I	4
MS 101, Military Science I or AS 121, Air Science I	1	MS 102, Military Science I or AS 122, Air Science I	1
PE 101, Physical Education	1	PE 102, Physical Education	1
	18		17

SECOND YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 201, Architectural Design I	4	ARC 202, Architectural Design II	4
DN 211, Descriptive Drawing III	2	DN 212, Descriptive Drawing IV	2
HI 245, European Civilization	3	EM 311, Mechanics I (Statics)	3
MA 201, Analytic Geometry and Calculus II	4	HI 246, European Civilization	3
PY 211, General Physics	4	PY 212, General Physics	4
MS 201, Military Science II		MS 202, Military Science II	
or		or	
AS 221, Air Science II	1	AS 222, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	19		18

Summer Requirement: Two weeks on Historic Architecture Research—Field Work

THIRD YEAR

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

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

FOURTH YEAR

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

FIFTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 501, Architectural Design VII	7	ARC 502, Architectural Design VIII	9
ARC 511, Professional Practice	2	ARC 532, Structural Design IV	2
ARC 531, Structural Design III	2	PHI 306, Philosophy of Art	3
DN 541, Seminar on Ideas in Design	2	Elective*	4
Elective*	6		18
	19		

* Six credits of elective will be required in the literature of English and three in the Social Sciences. The remaining ten hours shall be free electives. (Total credits for Bachelor of Architecture—190.)

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

CURRICULUM

FIRST YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 101, Design I	3	DN 102, Design II	3
DN 111, Descriptive Drawing I	2	DN 112, Descriptive Drawing II	2
DN 121, Technical Drawing I	3	DN 122, Technical Drawing II	3
ENG 111, Composition	3	ENG 112, Composition	3
MA 101, Algebra and Trigonometry	5	MA 102, Analytic Geometry and Calculus I	4
MS 101, Military Science I or AS 121, Air Science I	1	MS 102, Military Science I or AS 122, Air Science I	1
PE 101, Physical Education	1	PE 102, Physical Education	1
	18		17

SECOND YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 201, Architectural Design I	4	ARC 202, Architectural Design II	4
BO 103, General Botany	4	DN 212, Descriptive Drawing IV	2
DN 211, Descriptive Drawing III	2	HI 246, European Civilization	3
HI 245, European Civilization	3	MIG 120, Physical Geology	3
PY 211, General Physics	4	PY 212, General Physics	4
MS 201, Military Science II or AS 221, Air Science II	1	MS 202, Military Science II or AS 222, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	19		18

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

THIRD YEAR

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

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

FOURTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 441, Plant Ecology	3	DN 412, Advanced Descriptive Drawing IV	2
DN 411, Advanced Descriptive Drawing III	2	DN 422, History of Design II	3
DN 421, History of Design I	3	LA 402, Landscape Design IV	6
LA 401, Landscape Design III	6	LA 422, Planting Design	4
LA 421, Planting Design	4	Electives*	6
Elective*	3		21
	21		

FIFTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 511, Advanced Descriptive Drawing V	2	DN 512, Advanced Descriptive Drawing VI	2
DN 541, Seminar or Ideas in Design	2	LA 502, Landscape Design VI	8
LA 501, Landscape Design V	6	PHI 306, Philosophy of Art	3
LA 511, Landscape Construction and Professional Practice	4	Electives*	6
Electives*	4		19
	18		

* Six credits of elective will be required in the literature of English and six in the Social Sciences. The remaining ten hours shall be free electives. (Total credits for the Bachelor of Landscape Architecture—190.)

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, John Hertzman, Clark Macomber
Instructor William J. Baron

CURRICULUM

FIRST YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 101, Design I	3	DN 102, Design II	3
DN 111, Descriptive Drawing I	2	DN 112, Descriptive Drawing II	2
DN 121, Technical Drawing I	3	DN 122, Technical Drawing II	3
ENG 111, Composition	3	ENG 112, Composition	3
MA 101, Algebra and Trigonometry	5	MA 102, Analytic Geometry and Calculus I	4
MS 101, Military Science I		MS 102, Military Science I	
or		or	
AS 121, Air Science I	1	AS 122, Air Science I	1
PE 101, Physical Education	1	PE 102, Physical Education	1
	18		17

SECOND YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 211, Descriptive Drawing III	2	DN 212, Descriptive Drawing IV	2
HI 245, European Civilization	3	HI 246, European Civilization	3
IE 217, Machine Tools	1	IE 218, Metal Forming	1
MA 201, Analytic Geometry and Calculus II	4	PD 202, Product Design and Orientation	4
PD 201, Product Design and Orientation	4	PSY 200, Introduction to Psychology	3
PY 211, General Physics	4	PY 212, General Physics	4
MS 201, Military Science II		MS 202, Military Science II	
or		or	
AS 221, Air Science II	1	AS 222, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	20		19

THIRD YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, General Inorganic Chemistry	4	CH 103, General Qualitative Chemistry	4
DN 311, Advanced Descriptive Drawing I	2	DN 312, Advanced Descriptive Drawing II	2
EC 425, Industrial Management	3	EM 312, Mechanics II (Dynamics)	3
EM 311, Mechanics I (Statics)	3	EM 321, Strength of Materials I	3
PD 301, Product Design	6	PD 302, Product Design	6
PD 331, Materials and Processes	3	PD 332, Materials and Processes	3
	21		21

FOURTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 411, Advanced Descriptive Drawing III	2	DN 412, Advanced Descriptive Drawing IV	2
IE 301, Engineering Economy	2	IE 425, Sales and Distribution Methods	2
PD 401, Advanced Product Design	6	PD 402, Advanced Product Design	6
PD 441, Design Analysis	2	PD 422, Office and Industrial Practice	2
Electives*	7	PD 442, Design Analysis	2
	19	Electives*	6
			20

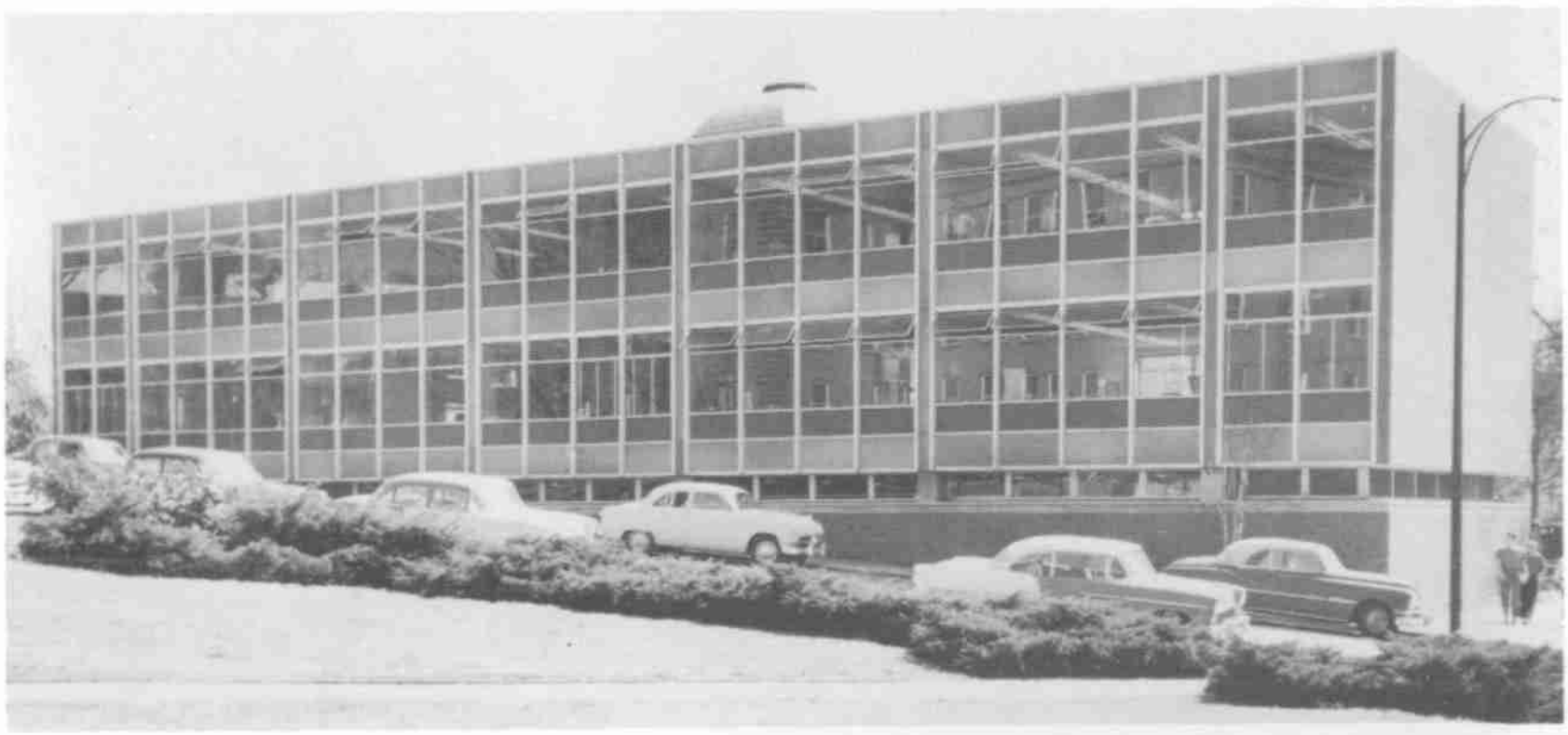
FIFTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 511, Advanced Descriptive Drawing V	2	DN 512, Advanced Descriptive Drawing VI	2
DN 541, Seminar on Ideas in Design	2	PD 502, Product Design Thesis	9
PD 501, Advanced Product Design	8	PSY 441, Human Factors in Equipment Design	3
PSY 464, Visual Perception	3	Electives*	3
Electives*	3		17
	18		

* Six credits will be required in the literature of English and three in the Social Sciences. The remaining ten hours shall be free electives. (Total credits for the Bachelor of Product Design—190.)

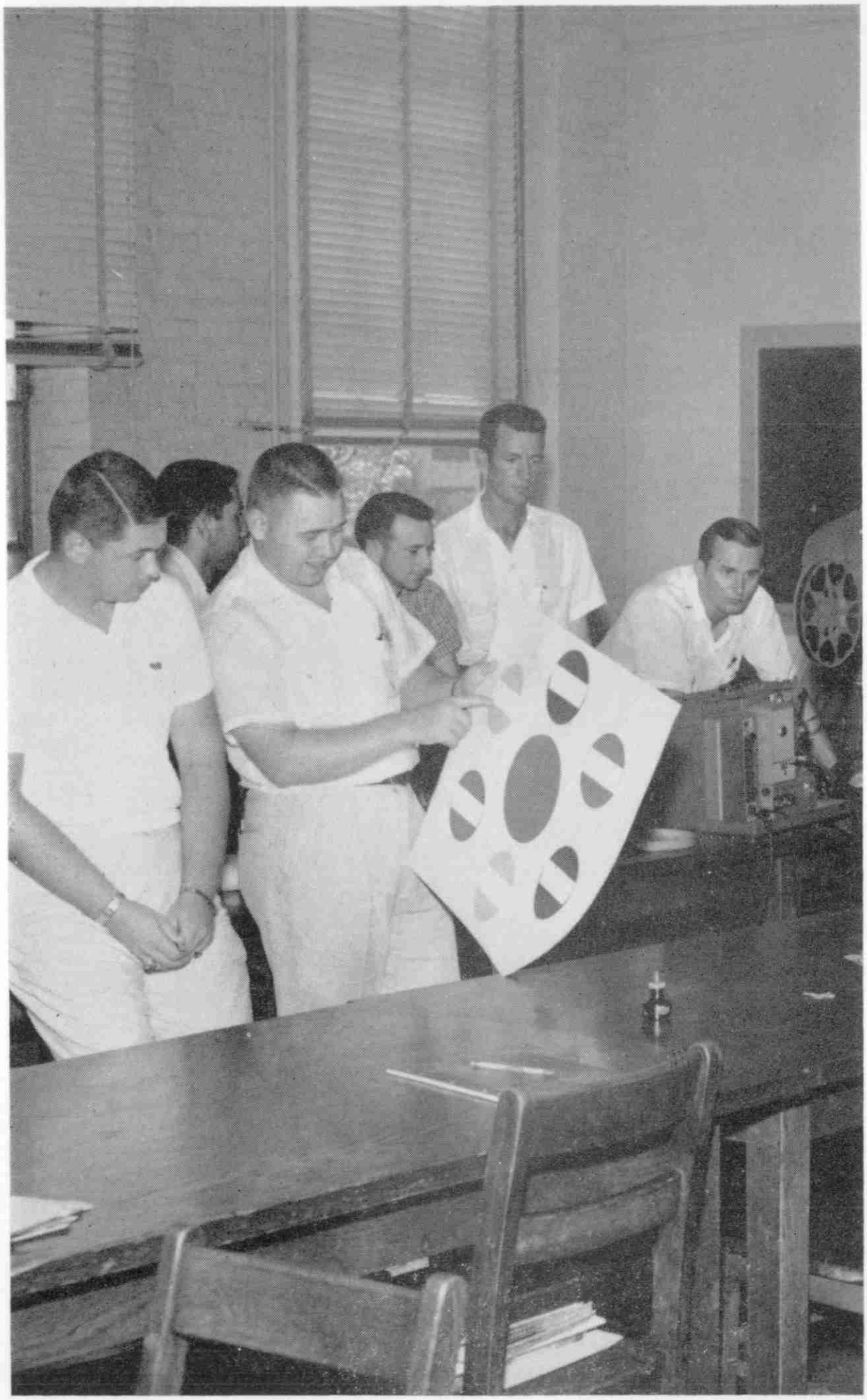
Kilgore and Brooks Halls

KILGORE HALL is the headquarters of the School of Forestry and the Department of Horticulture. (The Forestry section is shown here.) The building is named for the late Dr. Benjamin Wesley Kilgore who was Dean of Agriculture at North Carolina State College from 1923 until 1925, and the first director of the North Carolina Agricultural Extension Service.



BROOKS HALL is the home of North Carolina State College's world-famous School of Design. The building is named for the college's fifth president, the late Dr. Eugene Clyde Brooks.

School of Education



SCHOOL OF EDUCATION

J. Bryant Kirkland, Dean

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, Mathematics and Science Education, Occupational Information and Guidance, Psychology, and Recreation and Park Administration.

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 Recreation and Park Administration 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 asistance 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 recreation and park administration 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 curricular in the School of Education, a student is eligible to receive the degree of Bachelor Science with the name of his area of specialization: in agricultural education, industrial arts, industrial education, mathematics education and science education, and recreation and park administration.

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.

AGRICULTURAL EDUCATION

Professor C. C. Scarborough, *Head of the Department*
Professor Emeritus J. K. Coggin
Professor J. Bryant Kirkland
Associate Professor G. B. James*
Assistant Professor T. R. Miller
Instructors C. D. Bryant, J. R. Clary
Visiting Lecturer H. E. Beam
*On Leave

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.

AGRICULTURAL EDUCATION CURRICULUM*

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
AG 103, Introduction to Agriculture	1	AGE 201, Agricultural Construction and Maintenance I	2
BO 103, General Botany	4	ENG 112, Composition	3
ED 102, Objectives in Agricultural Education	1	ZO 103, General Zoology	4
ENG 111, Composition	3	MS 102, Military Science I or	
MA 111, Algebra and Trigonometry	4	AS 122, Air Science I	1
MS 101, Military Science I or		PE 102, Physical Education	1
AS 121, Air Science I	1	Agriculture Elective	3
PE 101, Physical Education	1	Free Elective	3
	15		17

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
AGE 202, Agricultural Construction and Maintenance II	2	AGC 212, Economics of Agriculture	3
CH 101, General Inorganic Chemistry	4	AGE 211, Farm Power and Machinery I	3
EC 201, Economics	3	CH 203, General and Organic Chemistry	4
PSY 304, Educational Psychology	3	ED 201, Farming Programs and FFA	2
MS 201, Military Science II or		MS 202, Military Science II or	
AS 221, Air Science II	1	AS 222, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
Agriculture Elective	3	History Elective	3
	17		17

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
AGC 311, Organization and Business Management of Marketing Firms	3	AGC 303, Organization and Business Management of Farms	3
RS 301, Sociology of Rural Life	3	ED 313, Teaching Rural People	2
SOI 200, Soils	4	ED 344, Secondary Education	2
Agricultural Engineering Elective	3	PSY 476, Psychology of Adolescence	2
Biological Science Elective	3	English Elective	3
Free Electives	3	Social Science Elective	3
	19	Free Electives	3
			18

SENIOR YEAR**

Fall Semester	*Credits*	*Spring Semester*	*Credits*
AGE 401, Problems in Farm Mechanics	3	ED 420, Principles in Guidance	2
ED 411, Student Teaching	6	Agriculture Electives	3
ED 412, Teaching Adults	2	English Elective	3
ED 413, Teaching Materials	2	Political Science Elective	3
RS 321, Introduction to Social Research	3	Free Electives	6
	16		17

* A minimum of 136 semester credits required for graduation.
** Summer Practice (2 weeks) is required prior to senior year.

INDUSTRIAL ARTS

Professor Ivan Hostetler, *Head of the Department*
Associate Professor Talmage B. Young
Assistant Professors Carl A. Moeller, Robert T. Troxler
Instructor Frank E. Briley

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 majoring in this area 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 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, industrial sales, estimating, job training, maintenance and installation.

Opportunities—The opportunities for employment as industrial arts teachers in North Carolina are greater than ever before. The demand of industrial arts teachers is greater than the supply. The demand for industrial employment is also very great.

Graduate Study—Opportunities are provided for qualified students 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.

INDUSTRIAL ARTS EDUCATION CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 111, Composition	3	ENG 112, Composition	3
IA 100, Introduction to Industrial Arts	1	IA 104, Drafting II	3
IA 103, Drafting I	3	IA 108, Woods II	3
IA 107, Woods I	3	MS 102, Military Science I	
MA 111, Algebra and Trigonometry	4	or	
MS 101, Military Science I		AS 122, Air Science I	1
or		PE 102, Physical Education	1
AS 121, Air Science I	1	Mathematics Elective	4
PE 101, Physical Education	1		—
	—		15
	16		

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, General Inorganic Chemistry	4	EC 205, Economic Process	3
IA 206, Metal Processing I	3	ENG 231, Basic Speaking Skills	3
PS 201, The American Governmental System	3	IA 207, Metal Processing II	3
PY 211, General Physics	4	PY 212, General Physics	4
MS 201, Military Science II or		SOC 202, Principles of Sociology	3
AS 221, Air Science II	1	MS 201, Military Science II or	
PE 201, Physical Education	1	AS 222, Air Science II	1
	16	PE 202, Physical Education	1
			18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 344, Secondary Education	2	ED 422, Methods of Teaching Industrial Subjects	4
IA 205, Industrial Arts Design	2	IA 304, General Shop Organization	2
IA 307, Basic Electricity	3	IA 308, Basic Electronics	3
PSY 304, Educational Psychology	3	PSY 476, Psychology of Adolescence	2
English Elective	3	Electives*	7
History Elective	3		18
*Electives	3		
	19		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 444, Student Teaching in Industrial Subjects	6	ED 420, Principles of Guidance	2
ED 482, Curriculum Problems in Industrial Arts	2	IA 480, Modern Industries	3
ED 483, Instructional Aids and Devices	2	*Electives	12
IA 465, Independent Study in Industrial Arts	3		17
IA 484, School Shop Planning and Equipment Selection	3		
*Electives	3		
	19		

* Twelve hours are to be technical electives; the remaining 13 hours are to be free electives.

INDUSTRIAL ARTS—TECHNICAL OPTION CURRICULUM

(Freshman and Sophomore Years same as in Industrial Arts Education)

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
IA 205, Industrial Arts Design	2	IA 308, Basic Electronics	3
IA 307, Basic Electricity	3	PSY 337, Industrial Psychology I	3
IE 310, Industrial Safety	2	SOC 301, Human Behavior	3
IE 332, Motion and Time Study	4	English Elective	3
PSY 200, Introduction to Psychology	3	History Elective	3
*Electives	3	*Elective	3
	17		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 425, Industrial Management	3	EC 426, Personnel Management	3
IA 321, Metalwork Technology	2	EC 432, Industrial Relations	3
IA 480, Modern Industries	3	IE 430, Job Evaluation and Wage Incentives	3
IE 408, Production Control	3	*Electives	10
*Electives	8		
	19		19

*Twelve hours are to be technical electives; the remaining 12 hours are to be free electives.

INDUSTRIAL EDUCATION

Professor Durwin M. Hanson

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 institutional 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 completion 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.

INDUSTRIAL EDUCATION CURRICULUM*

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 100, Introduction to Industrial Education	2	ENG 112, Composition	3
ENG 111, Composition	3	HI History Elective	3
IA 103, Drafting I	3	IA 104, Drafting II	3
MA 111, Algebra and Trigonometry	4	MA 122, Mathematics of Finance and Elementary Statistics	4
MS 101, Military Science I or		MS 102, Military Science I or	
AS 121, Air Science I	1	AS 122, Air Science I	1
PE 101, Physical Education	1	PE 102, Physical Education	1
	14		15

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, General Inorganic Chemistry	4	EC 205, Economics	3
ENG English Elective	3	PY 212, General Physics	4
PY 211, General Physics	4	SOC 202, Principles of Sociology	3
PS 201, The American Government System	3	MS 202, Military Science II or AS 222, Air Science II	1
MS 201, Military Science II or AS 221, Air Science II	1	PE 202, Physical Education	1
PE 201, Physical Education	1	Elective	5
Elective	3		17
	19		

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 312, Accounting for Engineers	3	ED 422, Methods of Teaching Industrial Subjects	4
ED 344, Secondary Education	2	ENG English Elective	3
IE 310, Industrial Safety	2	PSY 476, Psychology of Adolescence	2
PSY 304, Educational Psychology	3	REC 333, First Aid and Safety	2
SOC 401, Human Relations in Industrial Society	3	Elective	9
Elective	6		20
	19		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 440, Vocational Education	2	ED 420, Principles of Guidance	2
ED 444, Student Teaching in Industrial Subjects	6	ED 516, Community Occupational Surveys	2
ED 483, Instructional Aids and Devices	2	ED 527, Philosophy of Industrial Education	2
ED 525, Trade Analysis and Course Construction	2	PSY 337, Industrial Psychology	3
Elective	3	Elective	8
	15		17

* A minimum of 136 semester credits required for graduation.

MATHEMATICS AND SCIENCE EDUCATION

Associate Professor Herbert E. Speece
Assistant Professor Henry A. Shannon

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.

MATHEMATICS EDUCATION CURRICULUM*

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, General Inorganic Chemistry	4	CH 103, General and Qualitative Chemistry	4
ENG 111, Composition	3	ENG 112, Composition	3
History Elective	3	MA 102, Analytic Geometry and Calculus I	4
MA 101, Algebra and Trigonometry	5	MA 122, Mathematics of Finance and Elementary Statistics	4
MS 101, Military Science or		MS 102, Military Science or	
AS 121, Air Science	1	AS 122, Air Science	1
PE 101, Physical Education	1	PE 102, Physical Education	1
	17		17

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 203, Introduction to Teaching	2	BO 103, General Botany or	
MA 201, Calculus II	4	ZO 103, General Zoology	4
PY 211, Physics	4	MA 202, Calculus III	4
SOC 202, Principles of Sociology	3	PY 212, Physics	4
MS 201, Military Science or		MS 202, Military Science or	
AS 221, Air Science	1	AS 222, Air Science	1
PE 201, Physical Education	1	PE 202, Physical Education	1
Electives	3	Electives	3
	18		17

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 205, Economic Process	3	CE 201, Surveying or	
PS 201, The American Governmental System	3	PY 223, Astronomy	3
PSY 304, Educational Psychology	3	ED 344, Secondary Education	2
Electives	10	English Elective	3
	19	**Electives	10
			18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 470, Methods of Teaching Math	3	ED 420, Principles of Guidance	2
***ED 471, Student Teaching in Math	6	MA 433, History of Math	3
ED 472, Developing and Selecting Teaching Materials in Math	2	**Electives	9
PSY 476, Psychology of Adolescence	2	English Elective	3
	13		17

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* A minimum of 136 semester credits required for graduation.

** A minimum of 6 semester hour electives in mathematics and 3 semester hours in mathematics or physical 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.

SCIENCE EDUCATION CURRICULUM*

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ZO 103, General Zoology	4	ZO 205, Invertebrate Zoology	4
History Elective	3	MA 112, Analytic Geometry and Calculus A	4
MA 111, Algebra and Trigonometry	4	BO 103, General Botany	4
ENG 111, Composition	3	ENG 112, Composition	3
MS 101, Military Science or AS 121, Air Science	1	MS 102, Miltiary Science or AS 122, Air Science	1
PE 101, Physical Education	1	PE 102, Physical Education	1
	16		17

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 301, General Morphology or BO 403, Systematic Botany	3	MIG 120, Physical Geology	3
CH 101, General Inorganic Chemistry	4	CH 103, General and Qualitative Chemistry	4
PS 201, The American Governmental System	3	ED 203, Introduction to Teaching	2
SOS 202, Principles of Sociology	3	ZO 213, Human Physiology	3
MS 201, Military Science or AS 221, Air Science	1	MS 202, Military Science or AS 222, Air Science	1
PE 201, Physical Education	1	PE 202, Physical Education	1
**Electives	3	**Electives	3
	18		17

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 203, General and Organic Chemistry	4	PSY 304, Educational Psychology	3
EC 205, The Economic Process	3	PY 212, Physics	4
ED 344, Secondary Education	2	**Electives	11
PY 211, Physics	4		18
English Elective	3		
**Electives	3		
	19		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 475, Methods of Teaching in Science	3	PY 223, Astronomy	3
***ED 476, Student Teaching in Science	6	BO 312, General Bacteriology	4
ED 477, Developing and Selecting Teaching Materials in Science	2	ED 420, Principles of Guidance	2
PSY 476, Psychology of Adolescence	2	**Elective	6
		English Elective	3
	13		18

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* A minimum of 136 semester credits required for graduation.

** A minimum of 6 semester hour electives in one area of 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 Training Center and approximately 6 weeks to concentrated courses.

RECREATION AND PARK ADMINISTRATION

Professor Thomas I. Hines, *Head of Department*
Associate Professor Latham L. Miller
Assistant Professors Charles C. Stott, Albert Crawford

Objectives—The Department of Recreation and Park Administration 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 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, or institutional recreation or park administration) and take courses designed to meet the needs in their respective area of specialization.

Opportunities—The demand of 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.

RECREATION ADMINISTRATION CURRICULUM*

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 111, Composition	3	BO 103, General Botany	4
History Elective	3	ENG 112, Composition	3
REC 152, Introduction to Recreation	3	PS 201, American Governmental System	3
ZO 103, General Zoology	4	REC 153, Aquatic Sports	2
MS 101, Military Science I		SOC 202, Principles of Sociology	3
or		MS 102, Military Science I	
AS 121, Air Science I	1	or	
PE 101, Physical Education	1	AS 122, Air Science I	1
	15	PE 102, Physical Education	1
			17

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 205, The Economic Process	3	ENG 215, Principles of News Writing	3
MA 111, Algebra and Trigonometry	4	MA 122, Mathematics of Finance and Elementary Statistics	
REC 201, Playground Leadership	2	or	
REC 251, Social Recreation I	3	EC 312, Accounting for Engineers	4
ZO 212, Human Anatomy	3	PSY 200, Introduction of Psychology	3
MS 201, Military Science II		REC 253, Principles of Physical Education	3
or		ZO 213, Human Physiology	3
AS 221, Air Science II	1	MS 202, Military Science II	
PE 201, Physical Education	1	or	
	17	AS 222, Air Science II	1
		PE 202, Physical Education	1
			18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 231, Basic Speaking Skills	3	REC 352, Team Sports in Recreation	3
REC 333, First Aid and Safety	2	REC 353, Camp Organization and Leadership	3
REC 351, Individual Sports in Recreation	3	SOC 301, Human Behavior	3
REC 354, Personal and Community Hygiene	3	**Electives	9
**Electives	7		18
	18		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
REC 451, Facilities and Equipment	3	REC 470, Supervised Practice	6
REC 452, Recreation Administration	3	REC 472, Observation and Field Experience	2
REC 471, Organizing the Recreation Program	2	**Electives	10
SOC 416, Research Methods	3		18
**Electives	7		
	18		

* A minimum of 139 semester credits required for graduation.

** At the end of the sophomore year, a student must select an area of special interest. At least 21 semester hours of course work must be taken from the list of elective courses in the chosen area.

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

EMPLOYEE RECREATION ELECTIVE COURSES

	Credits		*Credits*
EC 315, Salesmanship	2	IA 314, Recreation Arts and Crafts	2
EC 401, Principles of Accounting	3	PSY 302, Psychology of Personality and Adjustment	3
EC 402, Principles of Accounting	3	PSY 337, Industrial Psychology I	3
EC 407, Business Law I	3	PSY 438, Industrial Psychology II	3
EC 411, Marketing Methods	3	PSY 490, Social Psychology	3
EC 412, Sales Management	3	REC 252, Social Recreation II	3
EC 420, Corporation Finance	3	REC 401, Principles and Practices of Industrial Recreation	2
EC 425, Industrial Management	3	SOC 302, Public Relations and Modern Society	3
EC 426, Personnel Management	3	SOC 305, Race Relations	3
EC 431, Labor Problems	3	SOC 401, Human Relations in Industrial Society	3
EC 432, Industrial Relations	3	SOC 501, Leadership	3
ED 308, Visual Aids	2		
ED 420, Principles of Guidance	2		
ENG 211, Business Communications	3		

PUBLIC RECREATION ELECTIVE COURSES

	Credits		*Credits*
EC 407, Business Law I	3	REC 315, Prevention and Care of Athletic Injuries	2
EC 426, Personnel Management	3	REC 325, Activities for the Handicapped Individual	2
ED 308, Visual Aids	2	REC 401, Principles and Practices of Industrial Recreation	2
ED 420, Principles of Guidance	2	REC 404, Principles and Practices of Rural Recreation	2
ENG 211, Business Communications	3	REC 411, Park Maintenance and Operation I	2
HRT 222, Introduction to Horticulture	3	REC 412, Park Maintenance and Operation II	2
HRT 342, Landscape Gardening	3	SOC 302, Public Relations and Modern Society	3
IA 314, Recreation Arts and Crafts	2	SOC 304, Contemporary Family Life	3
PS 202, County and Municipal Government	3	SOC 305, Race Relations	3
PS 502, Public Administration	3	SOC 306, Delinquency and Crime	3
PS 510, Public Finance	3	SOC 402, Urban Sociology	3
PSY 302, Psychology of Personality and Adjustment	3	SOC 411, Community Relationships	3
PSY 304, Educational Psychology	3	SOC 501, Leadership	3
PSY 476, Psychology of Adolescence	2	ZO 312, Principles of Game Management	3
REC 203, Individual Corrective Physical Education	2	ZO 321, Wildlife and Natural Resource Conservation	3
REC 207, History and Principles of Park Administration	2		
REC 252, Social Recreation II	3		
REC 301, Organization and Administration of Physical Education	2		

INSTITUTIONAL RECREATION ELECTIVE COURSES

	Credits
EC 407, Business Law I	3
EC 426, Personnel Management	3
ED 308, Visual Aids	2
ED 420, Principles of Guidance	2
ENG 211, Business Communications	3
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
PS 510, Public Finance	3
PSY 302, Psychology of Personality and Adjustment	3
PSY 304, Educational Psychology	3
PSY 307, General Applied Psychology	2
PSY 490, Social Psychology	3
PSY 530, Abnormal Psychology	3
REC 203, Individual Corrective Physical Education	2
REC 252, Social Recreation II	3
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 401, Principles and Practices of Industrial Recreation	2
REC 404, Principles and Practices of Rural Recreation	2
SOC 302, Public Relations and Modern Society	3
SOC 304, Contemporary Family Life	3
SOC 305, Race Relations	3
SOC 306, Delinquency and Crime	3
SOC 402, Urban Sociology	3
SOC 411, Community Relationships	3
SOC 501, Leadership	3

PARK ADMINISTRATION CURRICULUM

Freshman year same as for Recreation Administration

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
AGE 201, Agriculture Construction and Maintenance I	2	AGE 202, Agriculture Construction and Maintenance II	2
BO 211, Dendrology	2	EC 205, Economic Process	3
ENG 215, Principles of News Writing	3	MA 122, Math of Finance and Elementary Statistics	
MA 111, Algebra and Trigonometry	4	or	
REC 207, History and Principles of Park Administration	2	EC 312, Accounting for Engineers	3
REC 251, Social Recreation I	3	PSY 200, Introduction to Psychology	3
MS 201, Military Science II		ZO 206, Vertebrate Zoology	4
or		MS 202, Military Science II	
AS 221, Air Science II	1	or	
PE 201, Physical Education	1	AS 222, Air Science II	1
		PE 202, Physical Education	1
	18		17

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MIG 120, Physical Geology	3	BO 403, Systematic Botany	3
REC 333, First Aid and Safety	2	ENG 231, Basic Speaking Skills	3
REC 352, Team Sports in Recreation	3	*Electives	12
*Electives	10		18
	18		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 441, Plant Ecology	3	REC 354, Personal and Community Hygiene	3
REC 353, Camp Organization and Leadership	3	REC 412, Park Maintenance and Operation II	2
REC 411, Park Maintenance and Operation I	2	REC 451, Facilities and Equipment	3
REC 452, Recreation Administration	3	ZO 522, Animal Ecology	3
REC 471, Organizing the Recreation Program	2	*Electives	7
*Electives	5		18
	18		

ELECTIVE COURSES

	Credits
AGE 341, Farm Electrification and Utilities	3
EC 426, Personnel Management	3
ENG 211, Business Communications	3
HRT 222, Introduction to Horticulture	3
HRT 301, Plant Propagation	3
HRT 342, Landscape Gardening	3
PS 202, County and Municipal Government	3
PS 502, Public Administration	3
PS 510, Public Finance	3
PSY 302, Psychology of Personality	3
PSY 490, Social Psychology	3
SOC 402, Urban Sociology	3
SOC 411, Community Relationship	3
SOC 416, Research Methods	3
SOC 501, Leadership	3
REC 252, Social Recreation II	3
REC 351, Individual Sports in Recreation	3
REC 404, Principles and Practices of Rural Recreation	2
ZO 312, Principles of Game Management	3
ZO 321, Wildlife and Natural Resource Conservation	3

• At least 21 semester hours of course work must be taken from the list of elective courses. Field Work: Evidence of at least four months of satisfactory experience in the practice of his profession is required for graduation.

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.

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.

Graduate Study—The program for the Master's Degree for school counselors meets the North Carolina School Counselors Certificate requirement. The graduate program for each student is determined by his needs, interests, educational background, and work experience. It would include a core of guidance courses as follows: ED 420, Principles of Guidance; ED 524, Occupational and Educational Information; ED 530, Group Guidance; ED 533, Administrative Relationships of Guidance Program; ED 631, Educational and Vocational Guidance; ED 633, Techniques in Guidance and Personnel; ED 641, Field Work (Supervised Practicum); ED 651, Research. Opportunity for field work is available in secondary schools, colleges, clinics, employment offices, and other agencies, according to the student's interests. Courses in psychology, sociology, economics, and education are selected to round out the program.

PSYCHOLOGY

Professor Howard G. Miller, *Head of the Department*
Professors Key L. Barkley, Harold M. Corter
Associate Professors John O. Cook, J. Clyde Johnson, Slater E. Newman, Paul J. Rust
Assistant Professors Donald W. Drewes, Clifton W. Gray
Visiting Professor William McGehee

Objectives—In general, the courses in psychology are designed to promote a broad understanding of behavior as a science and to cultivate the skills which may be useful in dealing with human beings in social, educational, industrial or other situations. The department, however, offers courses of interest to students in all schools.

Graduate Study—Graduate work is offered in the Department of Psychology leading to the Master of Science degree with options in industrial psychology, experimental psychology and school psychology.

School of Engineering

SCHOOL OF ENGINEERING

John Harold Lampe, Dean
Robert G. Carson, Director of Instruction
W. E. Adams, Coordinator of Student Affairs

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 education, 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 eight engineering departments: Chemical, Civil, Electrical, Industrial, Mechanical, Mineral Industries, Mechanics, and Research. A committee also administers a nuclear engineering program. Undergraduate degree programs are offered in the first six named departments and in nuclear engineering. 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 ceramic, chemical, civil, electrical, mechanical and nuclear engineering.

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 this 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, and so forth) 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 publications, 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 Science in Engineering*—The four-year curricula offer programs of study leading to a Bachelor's degree in agricultural, ceramic, chemical, civil, electrical, geological, industrial, mechanical, metallurgical 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 146 semester credit hours. A minimum scholastic record of a C average is also required.

Nuclear Engineering—Problems in nuclear engineering fall into several areas, including instrumentation and control, power, materials, processing and processes, and waste disposal. The electives available to the student offer an opportunity for the undergraduate to specialize in nuclear problems. For example, a student in electrical engineering may take several courses during his junior and senior years which can provide background and application of electrical engineering to reactor problems. Other examples would be power application by the mechanical engineering student, processing and processes by the chemical engineering student, reactor materials by the metallurgical engineering student or the ceramic engineering student, or waste disposal by the civil engineering student. The student is referred to the announcements of the individual departments for further information.

Graduate studies in nuclear engineering may be pursued in any appropriate department in the School of Engineering, thus providing for a number of fields of specialization.

Specialized Degree—Specialized Bachelor of Science degree is also offered through a program of study in furniture manufacturing and management. The course is planned for four years of study. Graduation requirements are the satisfactory completion of all the required courses and other courses which amount to a minimum total of 146 semester credit hours. A minimum scholastic record of C average is also required.

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, mechanical, and metallurgical engineering.

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 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—This is an earned graduate degree offered in ceramic, chemical, civil, electrical, mechanical and nuclear engineering. Admission requirements are the same as for the Master's degree. It requires at least two years of graduate work in one of these listed major programs and a minor either in some field of engineering or in an allied science. The dissertation will 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—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 North Carolina.

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—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.

FRESHMAN YEAR IN ALL ENGINEERING CURRICULA

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, General Inorganic Chemistry and Qualitative Analysis	4	CH 103, General Inorganic Chemistry and Qualitative Analysis	4
ENG 111, Composition	3	ENG 112, Composition	3
E 100, Introduction to Engineering	1	EC 205, The Economic Process or HI 205, The Modern Western World	3
**MA 101, Algebra and Trigonometry	5	**MA 102, Analytical Geometry and Calculus I	4
ME 101, Engineering Graphics I	2	ME 102, Engineering Graphics II	2
MS 101, Military Science or AS 121, Air Science	1	MS 102, Military Science or AS 122, Air Science	1
*PE 101, Physical Education	1	*PE 102, Physical Education	1
	17		18

* 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 Programs for Engineering Students*—A specially designed sequence of courses comprising 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 electives in the last year may be chosen from a group of approved courses which are built upon and closely related to the subject matter of the previous three years.

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
		HI 205, The Modern Western World or EC 205, The Economic Process	3

*SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
HI 205, The Modern Western World or ENG 205, Reading for Discovery or EC 205, The Economic Process	3	HI 205, The Modern Western World or ENG 205, Reading for Discovery or EC 205, The Economic Process	3

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3

****SENIOR YEAR**

Spring Semester	*Credits*	*Spring Semester*	*Credits*
SS 491, Contemporary Issues I or Approved Elective (see list below)	3	SS 492, Contemporary Issues II or Approved Elective (see list below)	3

SENIOR ELECTIVES FOR HUMANITIES—SOCIAL STUDIES PROGRAM

	Credits		*Credits*
SS 491, Contemporary Issues I	3	SOC 401, Human Relations in Industrial Society	3
SS 492, Contemporary Issues II	3	PHI 395, Philosophical Analysis	3
HI 412, Recent United States History	3	EC 442, Evolution of Economic Ideas	3
ENG 468, Major American Writers	3	GN 301, Genetics in Human Affairs	3
PS 401, American Parties and Pressure Groups	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.

**The student must take either SS 491, Contemporary Issues I, or SS 492; Contemporary Issues II. He must select an elective from the senior electives list for the other senior semester.

Courses from the approved list of senior electives will not be credited to the humanities sequence unless taken during the senior year.

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 Department of Agricultural Engineering in the School of Agriculture.

CHEMICAL ENGINEERING

Professor E. M. Schoenborn, *Head of the Department*
Professor K. O. Beatty, Jr.
Associate Professors R. Bright, J. F. Seely,
Assistant Professor E. R. Conway
Instructors W. M. Cooper, S. T. Goforth, Jr., L. Lenas
Visiting Associate Professor in Engineering Research A. A. Armstrong

Objectives—Chemical engineering is concerned with the design of processes, equipment and plants in which chemical and physical transformations of matter are carried out. Typical industries relying heavily upon chemical engineering include those producing chemicals, polymers, metals, drugs, glass, food, gasoline, paper, soap and cement; those producing energy from nuclear fuels; and those processing materials by methods involving chemical reactions. The preparation of men qualified to pursue careers in such industries as these is the purpose of the curriculum in chemical engineering.

Curriculum—The work of the chemical engineer is extremely diversified and consequently his education must be along broad and basic lines. The spirit of research and experimentation is a vital part of the chemical

industry and even those in the undergraduate curriculum need to acquire the sound scientific background essential to original thought and independent accomplishment. 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.

Chemical engineers have played the single biggest role in the atomic energy field. The future of production of nuclear fuels, the operation and design of reactors, and the procession of irradiated materials presents a multitude of chemical engineering problems. By judicious use of his electives, the student in chemical engineering may obtain specialized knowledge in the area of nuclear engineering.

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, atomic energy, and allied fields 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 training. In fact, the need for persons who have had advanced training in the field beyond the regular four-year program is continually increasing.

CHEMICAL ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CHE 205, Chemical Process Principles	4	CHE 311, Introductory Chemical Engineering	4
*EC 205, The Economic Process		*ENG 205, Reading for Discovery	
or		or	
ENG 205, Reading for Discovery	3	EC 205, The Economic Process	3
MA 201, Analytical Geometry and Calculus II	4	MA 202, Analytical Geometry and Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
MS 201, Military Science II		MS 202, Military Science II	
or		or	
AS 221, Air Science II	1	AS 222, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	18		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 215, Quantitative Analysis	4	CH 532, Physical Chemistry	3
CH 531, Physical Chemistry	3	CHE 412, Unit Operations II	3
CHE 411, Unit Operations I	3	EE 320, Elements of Electrical Engineering	4
EM 341, Engineering Mechanics A	2	EM 342, Engineering Mechanics B	2
SS 301, Contemporary Civilization	3	EM 343, Strength of Materials A	2
Elective	3	SS 302, Contemporary Civilization	3
	18	Elective	3
			20

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 425, Organic Chemistry	3	CH 426, Organic Chemistry	3
CHE 415, Chemical Engineering Thermodynamics	4	CHE 432, Unit Operations Lab II	3
CHE 431, Unit Operations Lab I	3	CHE 525, Process Measurement and Control	3
CHE 460, Seminar	1	MIM 321, Metallurgy	3
CHE 527, Chemical Process Engineering	3	*SS 492, Contemporary Issues II	
*SS 491, Contemporary Issues I		or	
or		Elective in Humanities	3
Elective in Humanities	3	Elective	3
Elective	3		18
	20		

* See page 110 for information about the Humanities Sequence.

PROFESSIONAL CURRICULUM (Typical Program)

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

Graduate Study—Regulations governing the Professional Program are shown on pages 138,139 and 140.

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. Of current interests are special programs in thermal properties of materials at both high and low temperatures, in process measurement and control, the use of radioactive tracers in chemical engineering research, and condensation in a centrifugal force field.

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

CIVIL ENGINEERING

Professor R. E. Fadum, *Head of Department*
Professors C. R. Bramer, C. R. McCullough, Carroll L. Mann, Jr., C. Smallwood, Jr., M. E. Uyanik
Associate Professor M. V. Smirnoff
Assistant Professors Michael Amein, R. H. Bigelow, E. P. Brantly, P. D. Cribbins, J. W. Horn, H. E. Wahls
Instructors L. S. Agnew, Jr., C. P. Fisher, R. M. Istrabadi, J. C. Smith, J. R. Walton

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, nuclear waste facilities, 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 Curriculum—The Department of Civil Engineering offers two four-year undergraduate curricula: the one, leading to the degree of Bachelor of Science in civil engineering; the other, to the degree of Bachelor of Science in 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.

CIVIL ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 201, Surveying I	3	CE 202, Surveying II	3
MA 201, Analytical Geometry and Calculus II	4	EM 311, Mechanics I (Statics)	3
PY 201, General Physics	5	MA 202, Analytical Geometry and Calculus III	4
*EC 205, The Economic Process		PY 202, General Physics	5
or		*ENG 205, Reading for Discovery	
ENG 205, Reading for Discovery	3	or	
MS 201, Military Science II		EC 205, The Economic Process	3
or		MS 202, Military Science II	
AS 221, Air Science II	1	or	
PE 201, Physical Education	1	AS 222, Air Science II	1
	17	PE 202, Physical Education	1
			20

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 305, Transportation Engineering I	3	CE 306, Transportation Engineering II	3
CE 321, Materials Testing Laboratory I	2	CE 322, Materials Testing Laboratory II	2
EM 312, Mechanics II (Dynamics)	3	CE 324, Structural Analysis I	3
EM 321, Strength of Materials I	3	CE 382, Hydraulics	3
MA 301, Differential Equations I	3	ME 301, Engineering Thermodynamics I	3
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Elective	3	Elective	3
	20		20

SENIOR YEAR

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

* See page 110 for information about the Humanities Sequence.

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.

CONSTRUCTION OPTION CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 201, Surveying I	3	CE 202, Surveying II	3
MA 201, Analytical Geometry and Calculus II	4	EM 311, Mechanics I (Statics)	3
PY 201, General Physics	5	MA 202, Analytical Geometry and Calculus III	4
*EC 205, The Economic Process		PY 202, General Physics	5
or		*ENG 205, Reading for Discovery	
ENG 205, Reading for Discovery	3	or	
MS 201, Military Science II		EC 205, The Economic Process	3
or		MS 202, Military Science II	
AS 221, Air Science II	1	or	
PE 201, Physical Education	1	AS 222, Air Science II	1
	17	PE 202, Physical Education	1
			20

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 321, Materials Testing Laboratory I	2	CE 322, Materials Testing Laboratory II	2
CE 361, Estimates and Costs I	3	CE 324, Structural Analysis I	3
EE 320, Elements of Electrical Engineering	4	CE 362, Estimates and Costs II	3
EM 312, Mechanics II (Dynamics)	3	EC 312, Accounting for Engineers	3
EM 321, Strength of Materials I	3	ME 301, Engineering Thermodynamics I	3
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Elective	3	Elective	3
	21		20

SENIOR YEAR

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

* See page 110 for information about the Humanities Sequence.

Professional Study in Civil Engineering—Fifth-year programs of study leading to the professional degree of 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 138, 139 and 140.

SANITARY ENGINEERING CURRICULUM

PROFESSIONAL

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 571, Theory of Water and Sewage Treatment	3	CE 572, Unit Operations and Processes in Sanitary Engineering	3
CE 573, Analysis of Water and Sewage	3	CE 598, Civil Engineering Projects	2
CE 598, Civil Engineering Projects	2	CE 672, Advanced Water and Sewage Treatment	4
CE 671, Advanced Water Supply and Sewerage	4	Electives	6
Elective	3		15
	15		

SOIL MECHANICS AND FOUNDATION ENGINEERING CURRICULUM

PROFESSIONAL

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 507, Airphoto Analysis I	3	CE 524, Analysis and Design of Masonry Structures	3
CE 621, Advanced Structural Analysis I	3	CE 544, Foundation Engineering	3
CE 641, Advanced Soil Mechanics	3	CE 548, Soil Testing for Engineering Purposes	3
MA 405, Introduction to Determinants and Matrices	3	CE 643, Hydraulics of Ground Water	3
Elective	3	Elective	3
	15		15

STRUCTURAL ENGINEERING CURRICULUM

PROFESSIONAL

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 521, Advanced Structural Design I	3	CE 522, Advanced Structural Design II	3
CE 621, Advanced Structural Analysis I	3	CE 544, Foundation Engineering	3
EM 551, Advanced Strength of Materials	3	CE 622, Advanced Structural Analysis II	3
MA 405, Introduction to Determnients and Matrices	3	EM 602, Theoretical and Applied Elasticity	3
Elective	3	Elective	3
	15		15

TRANSPORTATION ENGINEERING CURRICULUM

PROFESSIONAL

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CE 515, Transportation Operations	3	CE 601, Transportation Planning	3
CE 516, Transportation Design	3	CE 602, Advanced Transportation Design	3
CE 603, Airport Planning and Design	3	CE 604, Urban Transportation Planning	3
Electives	6	Electives	6
	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, struct-

ural engineering and transportation engineering. For additional information concerning graduate study opportunities in civil engineering, the current issue of the Graduate School Catalog 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 N. R. Bell, K. B. Glenn, A. J. Goetze, E. G. Manning, W. C. Peterson, E. W. Winkler
Adjunct Assistant Professor W. P. Seagraves
Instructors J. C. Dowdle, D. I. Fairbanks, F. L. Thurstone, R. L. Thurstone, T. B. Smiley, C. H. Voss, Jr.

Objectives—The purpose of the undergraduate curriculum is to train young people, either for active work in a challenging and diversified field, or for further study on the graduate level. To achieve this a thorough grounding is given in engineering science, followed by a solid foundation in fundamental electrical theory, and by advanced subject matter of sufficient breadth to insure adequate preparation for a dynamic profession. This background is essential for success, whether the particular field be automatic control, computers, communications, telemetering, electronics, the design of electrical equipment, the manufacture of electrical equipment, electric power production, the utilization of electric power, electronics in medicine, instrumentation or any other one of the vital fast developing fields using electricity either as muscles or as nerves.

Curriculum—The curriculum in electrical engineering includes comprehensive training in mathematics and physics—the fundamental sciences—and adequate training in allied branches of engineering. Most courses are accompanied by coordinated work in the laboratory and drill in the application of theory by means of carefully planned problems.

Each student has a choice of two out of eight senior elective courses in the department, and also has a choice of four courses from any of the offerings at State College. Near the end of the sophomore year, each student is asked to consider his electives and to plan a coordinated program of courses suited to his particular needs and interests.

Examinations are given each week to sophomore students in the electrical engineering course. In the junior year, examinations are given every three weeks, and in the senior year, they are given about every five weeks. This decreasing frequency of examinations is intended to encourage the student to assume more and more responsibility for the success of his own program.

Facilities—The Electrical Engineering Department is housed in Daniels Hall. In addition to offices and classrooms this building provides laboratories for the study of servomechanisms and control, electronics and communications, circuits, instrumentation, illumination, and electrical machinery. There are also a student study room, a shop, and a number of research laboratories.

Also available to the student are the services of an IBM 650 computer for research.

Graduation Requirements—Requirements for graduation are passing grades in the courses listed in the electrical engineering curriculum, passing of 147 credit hours, a grade point average of 2.00 or better, demonstration of

proficiency in written English, tested in the junior year. Students receiving D grades in both ENG 111 and ENG 112 will be required to repeat ENG 111.

Attendance at two professional society meetings of state-wide or larger scope, once in the spring of the junior year and once in the fall of the senior year is required. Attendance at three subsection meetings is considered the equivalent of one state-wide meeting, in meeting this requirement.

Also a minimum of six continuous weeks of gainful employment is required. This employment may be as laborer, sub-professional, or professional assistant in any of the following fields: industrial manufacture, repair service, or sales; industrial engineering or scientific research; engineering or architectural design and drafting; engineering exploration, surveying, or reconnaissance; construction of engineering works. Technical work while in military service does not satisfy this requirement.

The student is responsible for obtaining his employment and supplying satisfactory evidence thereof to the department. This evidence will consist of a letter from the employer to the head of the department setting forth inclusive dates of employment; character of work performed; type of operation of firm or individual; an evaluation of the student's work.

Student 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 Engineers' 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.

ELECTRICAL ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 201, Elementary Circuits and Fields	4	EE 202, Elementary Circuits and Fields	4
EC 205, The Economic Process or		EC 205, The Economic Process or	
**ENG 205, Reading for Discovery	3	**ENG 205, Reading for Discovery	3
MA 201, Analytical Geometry and Calculus II	4	MA 202, Analytical Geometry and Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
*MS 201, Military Science II or		*MS 202, Military Science II or	
*AS 221, Air Science II	1	*AS 222, Air Science II	1
*PE 201, Physical Education	1	*PE 202, Physical Education	1
	18		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 301, Intermediate Circuits and Fields	4	EE 302, Intermediate Circuits and Fields	3
EE 305, Electrical Machinery	4	EE 414, Electronics	4
EM 311, Mechanics I (Statics)	3	EM 312, Mechanics II (Dynamics)	3
PY 407, Introduction to Modern Physics	3	MA 301, Differential Equations	3
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Elective	3	Elective	3
	20		19

SENIOR YEAR

Fall Semester	*Credits*
EE 411, Electrical Engineering Senior Seminar	1
EE 501, Advanced Circuits and Fields	3
ME 301, Engineering Thermo-dynamics I	3
**SS 491, Contemporary Civilization	
or	
Elective Humanities	3
Departmental Electives	3
Electives	3
One of the following:	
MA 405, Introduction to Determinants and Matrices	
MA 411, Introduction to Applied Mathematics	
MA 501, Numerical Analysis I	
MA 511, Advanced Calculus I	
MA 532, Differential Equations II	
MA 541, Vector Analysis	
ST 361, Introduction to Statistics For Engineers I	3
	19

Spring Semester	*Credits*
EE 502, Advanced Circuits and Fields	3
EM 321, Strength of Materials I	3
ME 303, Engineering Thermo-Dynamics III	3
**SS 492, Contemporary Civilization	
or	
Elective in Humanities	3
Departmental Electives	3
Electives	3
	18

* Students excused from Military or Air Science and/or Physical Education will schedule equivalent credits in courses outside their department.
** See page 110 for information about the Humanities Sequence.

Professional Degree—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. Regulations governing the Professional Degree are shown on pages 138, 139 and 140.

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

Graduate work in electrical engineering at the first-year of master's level divides naturally into fields such as electronics, automatic control, computers, and power systems. In the more advanced study required for the doctorate, however, this distinction tends to disappear.

Advanced courses of a general and fundamental nature, such as electric network synthesis and advanced electromagnetic theory, are recommended for all graduate students in electrical engineering, especially those who plan to carry their advanced studies to the level of the doctorate. Minor sequences of study in advanced mathematics or physics are planned to fit the needs of individual students.

Holders of graduate degree in electrical engineering at North Carolina State College are in continual demand. Alumni hold important positions in industrial, government, and university research laboratories, in the teaching profession, and in the administrative and engineering departments of manufacturing corporations and public utilities.

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 P. H. McDonald, *Head of Department*
Professor Adolphus Mitchell
Associate Professor R. A. Douglas
Visiting Associate Professor Shou-ling Wang
Assistant Professors Maurice H. Clayton, J. P. Lamb, George W. Middleton
Instructors Halbert F. Brinson, Joe W. Reece

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 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.

ENGINEERING RESEARCH

N. W. Conner, *Director*
Research Professors R. F. Stoops, H. H. Stadelmaier
Research Associate Professor F. M. Richardson
Research Engineer Hayne Palmour III
Research Associates K. R. Brose, S. W. Derbyshire, A. E. Lucier
Research Assistants A. C. Fraker, J. V. Hamme, P. K. Maitra, R. B. Moffitt, J. Singletary, Jr., Thurman Upchurch

INDUSTRIAL EXPERIMENTAL PROGRAM

Research Professor and Head W. C. Bell
Research Engineers A. A. Carlyle, J. R. Ogburn, W. G. Yamamoto
Research Associates S. D. Coward, L. B. McGee
Chemical Engineer J. A. Macon
Industrial Specialist F. L. Eargle
Industrial Waste Specialist D. N. Cote

MINERALS RESEARCH LABORATORY

Chief Engineer W. T. McDaniel
Ore Dressing Engineers I. Redeker, T. J. Wright
Chemical Engineer P. N. Sales

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 fulltime 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 available 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, R. W. Llewellyn
Visiting Professor R. Willard
Assistant Professors R. Alvarez, R. L. Cope, J. Stanislao
Instructors C. E. Hunter, H. A. Knappenberger, G. E. Tucker

Objectvies—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 operation 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 exisiting 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 America Institute of Industrial Engineers. This student function has demonstrated its calibre by ranking high in the Annual Student Award every year in competition with the 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 industrial engineering students and the department.

INDUSTRIAL ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
***HI 205, The Modern Western World		***ENG 205, Reading for Discovery	
or		or	
ENG 205, Reading for Discovery	3	HI 205, Modern Western World	3
IE 201, Industrial Engineering I	3	IE 202, Industrial Engineernig II	3
IE 217, Machine Tools	1	MA 202, Analytical Geometry and Calculus III	4
IE 218, Metal Forming	1	PY 202, General Physics	5
MA 201, Analytical Geometry and Calculus II	4	PSY 200, Introduction to Psychology	3
PY 201, General Physics	5	MS 202, Military Science	
MS 201, Military Science		or	
or		AS 222, Air Science	1
AS 221, Air Science	1	PE 202, Physical Education	1
PE 201, Physical Education	1		20
	19		

JUNIOR YEAR*

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 312, Accounting for Engineers	3	EM 342, Mechanics B (Dynamics)	2
EM 341, Mechanics A (Statics)	2	IE 303, Industrial Engineering IV	4
IE 303, Industrial Engineering III	4	** MA 405, Introduction to Determinants and Matrices	3
MA 301, Differential Equations I	3	SS 302, Contemporary Civilization	3
SS 301, Contemporary Civilization	3	**ST 362, Statistics for Engineers	3
ST 361, Statistics for Engineers	3	Elective	3
Elective	3		18
	21		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 331, Principles of Electrical Engineering	4	EE 332, Principles of Electrical Engineering	4
EM 343, Strength of Materials A	2	**IE 402, Industrial Engineering Analysis	3
**IE 401, Industrial Engineering Analysis	3	***SS 492, Contemporary Issues II	
IE 451, Seminar	1	or	
ME 301, Engineering Thermodynamics	3	Humanities Elective	3
***SS 491, Contemporary Issues I		Technical Elective	3
or		Elective	3
Humanities Elective	3		16
Elective	3		
	19		

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* Proficiency in written expression to be demonstrated at the beginning of the junior year. Students who fail this test are required to take additional work in the English Department as recommended by the Industrial Engineering Department head.

** At the end of the sophomore year, students in the Industrial Engineering curriculum will be permitted to choose between two sequences of four courses each in their junior and senior years. The sequences are (1) Math 405, ST 362, IE 401, and IE 402; and (2) MIM 201, IE 350, IE 404, IE 515. The first sequence is designed to emphasize mathematical techniques in management decision making. The second series emphasizes work relating to production and manufacturing engineering. More active participation in the technical aspects of planning, tooling, and improving manufacturing operations will be expected from graduates who take the latter sequence. At least one of the above sequences must be completed to fulfill graduation requirements.

*** See page 110 for information about the Humanities Sequence.

Professional Study—A fifth, or professional year of study is offered in industrial engineering by means of specialized and advanced course work. Students may elect a specialty area in consultation with his adviser and then develop a program of study which suits his interests. A student may specialize in production engineering, in decision-making processes as related to industrial engineering, or in administrative engineering. Typical programs in each of these areas are presented below. This fifth year of study leads to the Professional degree in industrial engineering. Regulations concerning the Professional Program are shown on pages 138, 139 and 140.

PRODUCTION ENGINEERING CURRICULUM

Fall Semester	*Credits*	*Spring Semester*	*Credits*
IE 515, Process Engineering	3	IE 404, Introduction to Tool Engineering	3
IE 517, Automatic Processes	3	IE 543, Standard Data	3
ST 515, Experimental Statistics for Engineers	4	IE 546, Advanced Quality Control	3
Elective	3	IE 581, Project Work	3
IE 581, Project Work	2	ST 516, Experimental Statistics for Engineers	3
	15		15

INDUSTRIAL ENGINEERING CURRICULUM

Fall Semester	*Credits*	*Spring Semester*	*Credits*
IE 521, Control Systems and Data Processing	3	IE 546, Advanced Quality Control	3
IE 651, Special Studies in Industrial Engineering	3	IE 621, Inventory Control Methods	3
ST 515, Experimental Statistics for Engineres	4	IE 651, Special Studies in Industrial Engineering	3
Electives	5	ST 516, Experimental Statistics for Engineers	3
	15	Elective	3
			15

ADMINISTRATIVE ENGINEERING CURRICULUM

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 504, Principles of Cost Accounting	3	EC 505, Principles of Cost Accounting	3
EC 525, Management Policy and Decision Making	3	IE 531, Quantitative Job Evaluation Methods	3
EC 531, Management of Industrial Relations	3	IE 546, Advanced Quality Control	3
ST 515, Experimental Statistics for Engineers	3	IE 551, Standard Costs for Manufacturing	3
Elective	3	ST 516, Experimental Statistics for Engineers	3
	15		15

Graduate Study—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 the 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

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 211, Business Communications	3	**ENG 205, Reading for Discovery	
FOR 202, Wood Structure and Properties I	3	or HI 205, The Modern Western World	3
**HI 205, The Modern Western World		ENG 231, Basic Speaking Skills	3
or		FOR 203, Wood Structure and Properties II	3
ENG 205, Reading for Discovery	3	IE 224, Wood Working Equipment	3
PSY 200, Introduction to Psychology	3	PY 212, General Physics	4
PY 211, General Physics	4	MS 202, Military Science	
MS 201, Military Science		or	
or		AS 222, Air Science	1
AS 221, Air Science	1	PE 202, Physical Education	1
PE 201, Physical Education	1		18
	18		

Summer Practicum: FOR 205-s, 206-s, 207-s, 208-s, 209-s

JUNIOR YEAR*

Fall Semester	*Credits*	*Spring Semester*	*Credits*
FOR 301, Wood Processes I	4	EC 312, Accounting for Engineers	3
IE 201, Industrial Engineering I	3	IE 202, Industrial Engineering II	3
IE 322, Furniture Design and Construction	2	IE 326, Furniture Manufacturing and Processing	4
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Technical Elective	3	TX 271, Upholstery Fabrics	2
Elective	3	Elective	3
	18		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
IE 303, Industrial Engineering III	4	EC 432, Industrial Relations	3
IE 341, Furniture Plant Layout and Design	3	IE 304, Industrial Engineering IV	4
IE 451, Seminar	1	IE 452, Seminar	1
ST 361, Introduction to Statistics for Engineers	3	**SS 492, Contemporary Issues II or Humanities Elective	3
**SS 491, Contemporary Issues I or Humanities Elective	3	Technical Elective	3
Elective	3	Elective	3
	17		17

* Proficiency in written expression to be demonstrated at the beginning of the junior year. Students who fail this test are required to take additional work in the English Department as recommended by the Industrial Engineering Department Head.
** See page 110 for information about the Humanities Sequence.

MECHANICAL ENGINEERING

Professor G. L. Goglia, *Acting Head of the Department*
Professors J. S. Doolittle, K. P. Hanson, R. B. Knight, R. M. Pinkerton, J. Woodburn
Associate Professors W. E. Adams, T. C. Brown, R. D. Cess, B. H. Garcia, Jr., E. L. Harrisberger, P. B. Leonard, J. K. Whitfield
Assistant Professors A. W. Futrell, Jr., T. B. Ledbetter, R. S. Lee, W. T. Snyder, J. T. Yen
Instructors O. A. Arnas, N. M. Beatty, D. L. Bernreuter, K. R. Crump, A. H. Eraslan, N. E. Greene, P. M. Hamilton, Jr., G. A. Myers, Jr., H. Oguro, G. H. Phillips, C. S. Rudisill, W. R. Stallings, E. H. Stinson, H. C. Topakoglu, B. D. Webb

Objectives—Engineers are motivated by a desire to satisfy human needs through the application of scientific principles in such a manner as to place the fruits of their work within the economic reach of vast segments of humanity. To identify and evaluate human needs, modern engineers must have a sound education in the basic sciences, mathematics, and the humanities. The gap between the discoveries of basic science and their application in the satisfaction of human needs is provided by an area of science known as the engineering sciences. It is with education in the engineering sciences and the development of talent in applying the principles of the engineering sciences that departments of engineering are principally concerned.

Mechanical engineering covers a broad spectrum of engineering responsibility in such areas as nuclear and conventional power generation, missiles, rockets, jet engines, propulsion systems for land, sea, and air vehicles, refrigeration, air conditioning, combustion of fuels, instrumentation of industrial processes, solar energy, and the design of a wide variety of technical systems. Aeronautical engineering shares responsibility with mechanical engineering for many of the areas described above but is principally concerned with the structural design and analysis of air and space vehicles and with the phenomena of air and space flight.

Because of the close relationship between mechanical and aeronautical engineering, both curricula are administered by the Department of Mechanical Engineering at North Carolina State College. There is close cooperation between the faculties of the two disciplines in which responsibility for such engineering sciences as thermodynamics, heat transfer, mass trans-

fer, gas dynamics, aeroelasticity, vibrations, lubrication, fluid mechanics, magnetohydrodynamics, areodynamics, and instrumentation theory are shared.

In cooperation with other departments in the School of Engineering the Department of Mechanical Engineering is prepared to offer work leading to a degree in nuclear engineering. Particular emphasis in the work of this department is placed on nuclear power, reactor heat transfer and the dynamics of reactor fluids.

Curriculum—The curriculum in mechanical engineering is based on a firm foundation in mathematics, physics, chemistry, humanities and social sciences. The student's knowledge in the basic engineering sciences germane to mechanical engineering is carefully developed in the courses offered in this department and other departments of the School of Engineering. Finally, the curriculum provides an active experience in which the student's creative talents and imagination are challenged in several areas of application. This experience is gained through a choice of courses in the senior year and required courses in experimental mechanical engineering.

The curriculum in aeronautical engineering is administered as an option in mechanical engineering. Generally speaking, the curricula in mechanical and aeronautical engineering differ slightly in the first three years. The point of departure occurs in the fourth year where the emphasis in the aeronautical engineering curriculum is placed on air and space structures and the aerodynamics of air and space vehicles

The four-year undergraduate curricula in both mechanical and aeronautical engineering prepares graduates who are equipped to profit from their experiences in the practice of engineering and to become early contributors in the solution of engineering problems of scientific and economic complexity. Both curricula offer a firm basis for further advanced study in graduate schools.

MECHANICAL ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
*ENG 205, Reading for Discovery or EC 205, The Economic Process	3	EM 311, Mechanics I (Statics)	3
IE 217, Machine Tools	1	*EC 205, The Economic Process or ENG 205, Reading for Discovery	3
MA 201, Analytical Geometry and Calculus II	4	IE 218, Metal Forming	1
PY 201, General Physics I	5	MA 202, Analytical Geometry and Calculus III	4
MS 201, Military Science II or AS 221, Air Science II	1	PY 202, General Physics II	5
PE 201, Physical Education	1	MS 202, Military Science II or AS 222, Air Science II	1
Elective	3	PE 202, Physical Education	1
	18		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 312, Mechanics II (Dynamics)	3	EM 321, Strength of Materials I	3
MA 301, Differential Equations I	3	EM 430, Fluid Mechanics	2
ME 301, Engineering Thermodynamics I	3	ME 302, Engineering Thermodynamics II	3
ME 305, Mechanical Engineering Laboratory I	1	ME 306, Mechanical Engineering Laboratory II	1
ME 311, Kinematics	3	ME 312, Dynamic Analysis	3
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Elective	3	Elective	3
	19		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 331, Principles of Electrical Engineering	4	EE 332, Principles of Electrical Engineering	4
ME 401, Power Plants	3	ME 406, Mechanical Engineering Laboratory IV	1
ME 405, Mechanical Engineering Laboratory III	1	ME 412, Machine Design II	3
ME 411, Machine Design II	3	ME 502, Heat Transfer	3
ME 441, Technical Seminar	1	MIM 422, Metallurgy II	2
MIM 421, Metallurgy I	2	MIM 423, Metallurgy Laboratory	1
*SS 491, Contemporary Issues I or Elective in Humanities	3	*SS 492, Contemporary Issues II or Elective in Humanities	3
Elective	3	Elective	3
	20		20

* See page 110 for information about the Humanities Sequence.

AERONAUTICAL OPTION CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
*ENG 205, Reading for Discovery or EC 205, The Economic Process	3	EM 311, Mechanics I (Statics)	3
IE 217, Machine Tools	1	*EC 205, The Economic Process or ENG 205, Reading for Discovery	3
MA 201, Analytical Geometry and Calculus II	4	IE 218, Metal Forming	1
PY 201, General Physics I	5	MA 202, Analytical Geometry and Calculus III	4
MS 201, Military Science II or AS 221, Air Science II	1	PY 202, General Physics II	5
PE 201, Physical Education	1	MS 202, Military Science II or AS 222, Air Science II	1
Elective	3	PE 202, Physical Education	1
	18		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 312, Mechanics II (Dynamics)	3	EM 321, Strength of Materials I	3
MA 301, Differential Equations	3	ME 302, Engineering Thermodynamics II	3
ME 301, Engineering Thermodynamics I	3	ME 306, Mechanical Engineering Laboratory II	1
ME 305, Mechanical Engineering Laboratory I	1	ME 351, Elements of Aeronautical Engineering	3
ME 311, Kinematics	3	ME 352, Aerodynamics	3
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Elective	3	Elective	3
	19		19

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 320, Elements of Electrical Engineering	4	ME 410, Jet Propulsion	3
ME 441, Technical Seminar	1	ME 456, Aeronautical Laboratory II	1
ME 459, Aircraft Structures	3	ME 462, Airplane Design II	3
ME 455, Aeronautical Laboratory I	1	ME 536, Aircraft Engines	3
ME 461, Airplane Design I	3	MIM 422, Metallurgy II	2
MIM 421, Metallurgy I	2	MIS 423, Metallurgy Laboratory	1
*SS 491, Contemporary Issues I or Elective in Humanities	3	*SS 492, Contemporary Issues II or Elective in Humanities	3
Elective	3	Elective	3
	20		19

* See page 110 for information about the Humanities Sequence.

Professional Study—A fifth, or professional year of study is offered in mechanical engineering for graduates who desire to return to the university for a program of concentrated study in a selected area. This program is intended primarily for practitioners and is, in no sense, a graduate program leading to the usual advanced degrees. The degree of mechanical engineer is conferred upon graduates of the fifth-year program.

TYPICAL PROGRAM

HEAT-POWER

Fall Semester	*Credits*
ME 501, Steam and Gas Turbines	3
ME 545, Project Work in Mechanical Engineering I	2
ME 601, Advanced Engineering Thermodynamics I	3
ME 603, Advanced Power Plants	3
ME 641, Mechanical Engineering Seminar I	1
Approved Elective	3
	15

Spring Semester	*Credits*
ME 521, Aerothermodynamics	3
ME 546, Project Work in Mechanical Engineering II	2
ME 604, Nuclear Power Plants	3
ME 642, Mechanical Engineering Seminar II	1
Approved Electives	6
	15

DESIGN

Fall Semester	*Credits*
MA 411, Introduction to Applied Mathematics	3
ME 515, Experimental Stress Analysis	3
MIM 521, Advanced Physical Metallurgy I	3
ME 545, Project Work in Mechanical Engineering I	2
ME 611, Advanced Machine Design I	3
ME 641, Mechanical Engineering Seminar I	1
	15

Spring Semester	*Credits*
EM 554, Vibration Problems	3
ME 517, Lubrication	3
MIM 522, Advanced Physical Metallurgy II	3
ME 546, Project Work in Mechanical Engineering II	2
ME 612, Advanced Machine Design III	3
ME 642, Mechanical Engineering Seminar II	1
	15

AERONAUTICAL

Fall Semester	*Credits*
ME 453, Applied Aerodynamics	3
ME 502, Heat Transfer	3
ME 552, Aircraft Applied Loads	3
ME 545, Project Work in Mechanical Engineering I	2
ME 641, Mechanical Engineering Seminar I	1
Approved Elective	3
	15

Spring Semester	*Credits*
ME 502, Heat Transfer	3
ME 554, Advanced Aerodynamic Theory	3
ME 546, Project Work in Mechanical Engineering II	2
ME 562, Advanced Aircraft Structures	3
ME 642, Mechanical Engineering Seminar II	1
Approved Elective	3
	15

Graduate Study—The purpose of graduate study in mechanical engineering is to prepare students for a career in research, development, and teaching. Hence, in addition to advanced study, research is an essential part of the graduate program. At present the Department of Mechanical Engineering offers the Master of Science degree in mechanical and aeronautical engineering and the Doctor of Philosophy degree in mechanical engineering. Since all graduate programs are administered by the Graduate School prospective applicants should consult the Graduate School Catalog.

MINERAL INDUSTRIES

Professor W. W. Austin, *Head of the Department*
Professors W. C. Bell, W. W. Kriegel, J. M. Parker, III, H. H. Stadelmaier, R. F. Stoops
Associate Professors W. C. Hackler, E. L. Miller, Jr.
Assistant Professor H. S. Brown
Instructors G. O. Harrell, L. E. Poteat

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 also are available for advanced work and specialization in each of these fields, and graduate programs leading to the Master's and Doctor's degree 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 facilities, 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, Metallurgical, and Petroleum 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 farternity 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 transfer, 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, dielectric 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 minor 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 nonmetallic 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 con-

struction 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, kyanite, 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. The metallurgical engineering curriculum is unique in the School of Engineering in that it provides a minor sequence of 12 credits in a related field of engineering or science to be elected by the student with his advisor.

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.

CERAMIC ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
**HI 205, Modern Western World or ENG 205, Reading for Discovery	3	**HI 205, Modern Western World or ENG 205, Reading for Discovery	3
MA 201, Analytical Geometry and Calculus II	4	MA 202, Analytical Geometry and Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
*MIM 201, Structure and Properties of Engineering Materials	3	CH 215, Quantitative Analysis	4
MS 201, Military Science II or AS 211, Air Science II	1	MS 202, Military Science II or AS 212, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	17		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 341, Physical Chemistry	3	CH 342, Physical Chemistry	3
EM 341, Mechanics A (Statics)	2	EM 342, Mechanics B (Dynamics)	2
MIC 301, Ceramic Operations I	4	EM 343, Strength of Materials A	2
MIG 120, Physical Geology	3	MIC 302, Ceramic Operations II	3
MIG 330, Mineralogy	3	MIC 312, Ceramic Process Principles I	4
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Elective	3	Elective	3
	21		20

Summer Requirements: Six weeks' industrial employment.

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MIC 413, Ceramic Process Principles II	4	EE 320, Elements of Electrical Engineering	4
MIC 415, Ceramic Engineering Design	2	MIC 414, Senior Thesis	3
MIC 420, Industrial Ceramics	3	MIC 416, Ceramic Engineering Design	2
MIC 425, Seminar	1	MIC 505, Research and Control Methods	3
MIG 531, Optical Mineralogy	3	**SS 492, Contemporary Issues II	
**SS 491, Contemporary Issues		or	
or		Humanities Elective	3
Humanities Elective	3	Elective	3
Elective	3		18
	19		

* 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 elective permitted in the third year.

** See page 110 for information about the Humanities Sequence.

Professional Year—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 careers in industrial production activities and technical service and sales. 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 138, 139 and 140.

TYPICAL PROFESSIONAL PROGRAM IN CERAMIC ENGINEERING

PROFESSIONAL STUDY

Fall Semester	*Credits*	*Spring Semester*	*Credits*
IE 408, Production Control	3	IE 332, Motion and Times Study	4
MIC 507, Advanced Ceramic Experiments	3	MIC 508, Advanced Ceramic Experiments	3
MIC 511, Advanced Studies in Firing	3	MIC 527, Refractories in Service	3
Electives	6	Electives	5
	15		15

GEOLOGICAL ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
**HI 205, Modern Western World or ENG 205, Reading for Discovery	3	**HI 205, Modern Western World or ENG 205, Reading for Discovery	3
MA 201, Analytical Geometry and Calculus II	4	MA 202, Analytical Geometry and Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
*MIG 120, Physical Geology	3	CH 215, Quantitative Analysis	4
MS 201, Military Science or AS 211, Air Science	1	MS 202, Military Science or AS 212, Air Science	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	17		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 341, Physical Chemistry	3	CH 342, Physical Chemistry	3
EM 341, Mechanics A (Statics)	2	EM 342, Mechanics B (Dynamics)	2
CE 201, Surveying I	3	EM 343, Strength of Materials	2
MIG 222, Historical Geology	3	MIG 372, Elements of Mining Engineering	4
MIG 330, Mineraloy	3	MIG 442, Petrology	3
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
Elective	3	Elective	3
	20		20

Summer Requirements: Six weeks' industrial employment or summer camp in Geological Engineering.

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 320, Electrical Engineering	4	EM 430, Fluid Mechanics	2
MIG 351, Structural Geology	3	MIG 412, Economic Geology	3
MIG 411, Economic Geology	3	MIG 452, Sedimentation and Stratigraphy	3
MIG 481, Senior Seminar	1	MIG 462, Geological Surveying	3
MIG 531, Optical Mineralogy	3	MIG 482, Senior Seminar	1
**SS 491, Contemporary Issues I or Humanities Elective	3	**SS 492, Contemporary Issues II or Humanities Elective	3
Elective	3	Elective	3
	20		18

* 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.
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.

** See page 110 for information about the Humanities Sequence.

Professional Study—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 Engineers.

Regulations covering Professional Study are shown on pages 138, 139 and 140.

TYPICAL PROFESSIONAL PROGRAM IN GEOLOGICAL ENGINEERING

PROFESSIONAL STUDY

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MIG 461, Engineering Geology	3	MIG 522, Petroleum Geology	3
MIG 571, Mining and Mineral Dressing	3	MIG 552, Geophysics	3
MIG 581, Geomorphology	3	MIG 572, Mining and Mineral Dressing	3
MIG 611, Advanced Economic Geology	3	MIG 612, Advanced Economic Geology	3
Elective	3	Elective	3
	15		15

METALLURGICAL ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
**HI 205, Modern Western World or ENG 205, Reading for Discovery	3	**HI 205, Modern Western World or ENG 205, Reading for Discovery	3
MA 201, Analytical Geometry and Calculus II	4	MA 202, Analytical Geometry and Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
*MIM 201, Structure and Properties of Engineering Materials I	3	CH 215, Quantitative Analysis	4
MS 201, Military Science or AS 211, Air Science	1	MS 202, Military Science or AS 212, Air Science	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	17		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 341, Physical Chemistry	3	CH 342, Physical Chemistry	3
EM 341, Mechanics A (Statics)	2	EM 342, Mechanics B (Dynamics)	2
IE 217, Machine Tools	1	EM 343, Strength of Materials	2
IE 218, Metal Forming	1	MIM 332, Physical Metallurgy II	3
MIM 331, Physical Metallurgy I	3	SS 302, Contemporary Civilization	3
SS 301, Contemporary Civilization	3	Minor Sequence Courses	3
Minor Sequence Courses	3	Elective	3
Elective	3		19
	19		

Summer Requirements: Six weeks' industrial employment.

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 430, Fluid Mechanics	2	EE 320, Electrical Engineering	4
MIM 401, Metallurgical Operations	4	MIM 402, Metallurgical Operations	4
MIM 431, Metallography	3	MIM 432, Metallography	3
MIM 451, Seminar	1	MIM 452, Seminar	1
**SS 491, Contemporary Issues I or Humanities Elective	3	Minor Sequence Courses	3
Minor Sequence Course	3	**SS 492, Contemporary Issues II or Humanities Elective	3
Elective	3	Elective	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.

** See page 110 for information about the Humanities Sequence.

PROFESSIONAL STUDY IN METALLURGICAL ENGINEERING

Regulations covering Professional Study are shown on pages 138, 139 and 140.

TYPICAL PROFESSIONAL PROGRAM IN METALLURGICAL ENGINEERING

PROFESSIONAL STUDY

Fall Semester	*Credits*
MIM 521, Advanced Physical Metallurgy	3
MIM 523, Metallurgical Factors in Design	2
MIM 445, Experimental Engineering	3
PY 407, Modern Physics	3
ME 502, Heat Transfer	3
MIM 451, Metallurgical Engineering Seminar	1
	15

Spring Semester	*Credits*
MIM 522, Advanced Physical Metallurgy	3
MIM 524, Metallurgical Factors in Design	2
MIM 446, Experimental Engineering	3
CHE 502, Electrochemical Engineering	3
ME 515, Experimental Stress Analysis	3
MIM 452, Metallurgical Engineering Seminar	1
	15

NUCLEAR ENGINEERING

Dr. H. A. Lamonds, *Coordinator of the Program*

The nuclear engineering curriculum is offered in response to the requirements of industry and research organizations for engineers equipped with a basic knowledge of nuclear technology. The curriculum is planned to include a core of required courses and a number of technical elective courses in engineering or mathematics.

The degree of Bachelor of Science in nuclear engineering is awarded upon satisfactory completion of the prescribed four-year curriculum. For those desiring further training, graduate programs terminating in a Master's or a Doctor of Philosophy degree in nuclear engineering is offered.

The nuclear engineering program is being reviewed during the 1960-61 school year with the aim of incorporating changes to keep abreast of this rapidly growing area of technology. Information on the new program may be obtained in late spring of 1961 from the Director of Instruction, School of Engineering.

NUCLEAR ENGINEERING CURRICULUM

For the freshman year, refer to page 110.

SOPHOMORE YEAR

Fall Semester	*Credits*
MA 201, Analytical Geometry and Calculus II	4
PY 201, General Physics	5
**HI 205, Modern Western World or ENG 205, Reading for Discovery	3
MS 201, Military Science or AS 221, Air Science	1
PE 201, Physical Education	1
Technical Electives	3
	17

Spring Semester	*Credits*
EM 341, Mechanics A (Statics)	2
MA 202, Analytical Geometry and Calculus III	4
PY 202, General Physics	5
**ENG 205, Reading for Discovery or HI 205, Modern Western World	3
MS 202, Military Science or AS 222, Air Science	1
PE 202, Physical Education	1
	16

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 342, Mechanics B (Dynamics)	2	MA 511, Advanced Calculus	
EM 343, Strength of Materials A	2	or	
MA 301, Differential Equations	3	MA 532, Advanced Differential Equations	3
PY 401, Intermediate Physics I		*ME 301, Engineering Thermodynamics I	3
or		PY 402, Intermediate Physics I	
PY 403, Intermediate Physics II	4	or	
PY 407, Introduction to Modern Physics	3	PY 404, Intermediate Physics, II	4
SS 301, Contemporary Civilization	3	PY 410, Nuclear Physics I	4
Elective	3	SS 302, Contemporary Civilization	3
	20	Elective	3
			20

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 320, Elements of Electrical Engineering	4	EM 430, Fluid Mechanics	2
PY 419, Introduction to Nuclear Engineering	2	PY 520, Physical Technology in Radioactivity	3
PY 518, Radiation Hazard and Protection	3	PY 530, Elementary Nuclear Reactor Theory	3
**SS 491, Contemporary Issues I		**SS 492, Contemporary Issues II	
or		or	
Elective in Humanities	3	Elective in Humanities	3
Technical Electives	5	Technical Electives	6
Elective	3	Elective	3
	20		20

* CHE 415 Chemical Engineering Thermodynamics, may be substituted.
** See page 110 for information about the Humanities Sequence.

Graduate Study—*Master of Science in Nuclear Engineering*—The Master of Science program in nuclear engineering provides study in reactor theory, 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, depending on the student's background.

Equipment available on campus for use in Master's and Doctor's research problems includes a heterogeneous nuclear reactor, homogeneous reactor, a subcritical assembly, and a 1 mev Van De Graaff Accelerator. Laboratory training is provided also using these reactors.

Doctor of Philosophy—In the spring of 1950 the Graduate School of the Consolidated University of North Carolina granted authority to enroll students for training to the doctorate level in nuclear engineering. Facilities and courses are available to accommodate a wide latitude of emphasis of programs within the framework of nuclear engineering. The usual rules and regulations of the Graduate School apply to students enrolled in the Doctorate Program. For general regulations, the Graduate School Catalog should be consulted.

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 program 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 30 days in advance of the semester in which admission is sought.

General Regulations—The following regulations of the School of Engineering will be observed:

1. An undergraduate enrolled at North Carolina State 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 six semester course credits.

2. Credit for professional work to be applied toward the requirements for the professional degree, not to exceed six 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


THE GOE MFG CO PAINESVILLE

SCHOOL OF FORESTRY

Richard J. Preston, Dean

Professors R. C. Bryant, R. M. Carter, J. O. Lammi, T. E. Maki, A. J. Stamm, B. J. Zobel
Professors Emeriti J. V. Hofmann, C. E. Libby, L. Wyman
Associate Professors C. A. Hart, R. G. Hitchings, W. D. Miller, T. O. Perry
Assistant Professors A. C. Barefoot, H. D. Cook, C. S. Hodges, C. G. Landes, R. J. Thomas
Instructor J. T. Rice

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 20th 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 62 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 professional fields of forest management, pulp and paper technology, and wood technology.

Curricula—The school offers undergraduate instruction leading to the degree of Bachelor of Science in the professional fields of forest management, wood technology, and pulp and paper technology. 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, and includes the fundamentals of sound business administration.

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.

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. The degree of Master of Science is offered for those desiring specialization in the fields of scientific research, and for students desiring a thorough professional background, the school offers the degree of Master of Forestry or Master of Wood Technology.

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 Laboratories—The School of Forestry is now housed in three new, modernly equipped buildings on the west side of the campus. Faculty offices, classrooms, and laboratories are now located in Kilgore Hall, the main forestry building. In addition, two buildings house specialized programs which are unique in the South.

Wood Products Laboratory—The Brandon P. Hodges Wood Products Laboratory is one of the largest and best equipped laboratories in existence for the conduct of research and training in wood technology. Staff offices, research facilities, wood structure, chemistry and physical properties laboratories are located in the Forestry building. In addition, the $360,000 Brandon P. Hodges Laboratory building was dedicated in 1960 and houses the wood machining, finishing, gluing and preserving laboratories, as well as the sawmill, dry kilns, and veneer plant. The laboratory provides service to the wood using industries in the development of methods of quality control, production control, operations analysis, and market analysis. Graduate students in wood technology participate in the laboratory's research program as a part of their advanced training.

Robertson Laboratory of Pulp and Paper Technology—The curriculum in pulp and paper technology is approved as the regional program to serve the Southeast. The $450,000 Robertson Laboratory, dedicated in 1957, provides unique and outstanding facilities for instruction and research. Located in the building are wood preparation, chemical, pulping, pulp and paper testing, and colorful laboratories, as well as digesters, and a small paper machine. Space and equipment are adequate to handle 40 seniors and 10 graduate students.

School Forests—The School of Forestry, with more than 82,000 acres of forest land 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.

The George Watts Hill Demonstration Forest is a tract of 1,500 acres located 16 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. This Piedmont area is supplemented by the 1,750 acre Hope Valley Forest near Chapel Hill.

The Wayah Recreational Area on the North Carolina National Forest near Franklin is located in a typical mountain forest. Facilities at this area have been leased from the Government and portions of the spring semester of the senior year and of the sophomore summer camp are held in permanent quarters of this mountain tract.

The Carl Alwin Schenck Memorial Forest of 250 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 school nursery, located on the campus, is equipped for instructional 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 as to what type of employment will be acceptable.

The 10-week sophomore summer camp is a requirement for students in forest management. This camp is prerequisite for junior standing. Students in forestry management are also required to attend camp during the last half of the spring semester of the senior year. Permanent, well equipped camps are maintained on these coastal, Piedmont, and mountain forests. A "C" average is required for admission to these camps.

Wood technology students are required to attend a 10-week practicum following the sophomore year. This practicum is prerequisite for junior standing. The first half of this period is devoted to laboratory exercises in machining, gluing, drying and finishing wood; preparation of particle board; operation safety and maintenance of equipment; and plant inspections. The second half covers experience in logging, milling, cruising, and graphic methods.

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 chemical supplies and 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 during a school year. A maintenance and supply fee of $20.00 is charged for both the summer camp and practicum.

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, water-shed 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.

More than 80 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.

Extension Programs—The Extension Forestry Department of the Agricultural Extension Service is a vital part of the school's forestry activities. This program serves the landowners and wood industries of the state. It is responsible for their understanding, acceptance, and application of new ideas and techniques developed through research and experience. The two major fields of program emphasis are forest management, where extension specialists train and work through the county agents; and wood products, where the specialists work more or less directly with wood industry owners and managers.

In cooperation with the College Extension Division, short courses are offered in a number of fields to provide men in industry an opportunity to keep abreast of modern developments in techniques and equipment.

Fellowships, Scholarships, and Loan Funds—A number of undergraduate scholarships, research assistantships and training 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 College Counseling Center assists in locating employment.

Honors Program—Students making exceptional academic records during their freshman and sophomore years may, with the approval of the faculty, elect to follow an honors program. These students are required to enroll in the core courses in the several curricula but are otherwise free to utilize their electives to develop individual courses of study designed to meet their needs and satisfy their interests, subject only to the approval of the honors adviser.

FRESHMAN YEAR IN ALL FORESTRY CURRICULA

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 103, General Botany	4	*BO 211, Dendrology	
		or	
**CH 101, General Inorganic Chemistry		*ME 101, Engineering Graphics	2
or		**CH 103, General and Qualitative Chemistry	
**CH 102, General Inorganic Chemistry	4	or	
ENG 111, Composition	3	**CH 104, General and Qualitative Chemistry	
FOR 101, Introduction to Forestry	1	or	
***MA 111, Algebra, Trigonometry	4	**CH 203, Chemistry	4
MS 101, Military Science		ENG 112, Composition	3
or		FOR 102, Introduction to Forestry	2
AS 121, Air Science	1	***MA 112, Analytic Geometry and Calculus A	4
PE 101, Physical Education and Hygiene	1	MS 102, Military Science	
		or	
		AS 122, Air Science	1
		PE 102, Physical Education and Hygiene	1
	18		17

* Forest Management and Wood Technology students take BO 211, Pulp and Paper students take ME 101.
** Forest Management students take CH 101 and 203, Wood Technology students take CH 101 and 103, Pulp and Paper students take CH 102 and 104.
*** 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, *Department Head*

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 24 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 151 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

For freshman year see page 146.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 212, Dendrology	2	SOI 200, Soils	4
FOR 202, Wood Structure and Properties	3	CE 201, Surveying	3
PY 211, General Physics	4	EC 201, General Economics	3
Social Science Elective	3	English Elective	3
ZO 103, General Zoology	4	Social Science Elective	3
MS 201, Military Science or AS 221, Air Science	1	MS 202, Military Science or AS 222, Air Science	1
PE 201, Physical Education and Hygiene	1	PE 202, Physical Education and Hygiene	1
	18		18

SUMMER CAMP

	Credits
FOR s204, Silviculture	2
FOR s214, Dendrology	2
FOR s224, Forest Mapping	2
FOR s264, Protection and Utilization	2
FOR s274, Mensuration	2
	10

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 421, Plant Physiology	4	FOR 362, Silvics	3
ENT 301, Forest Insects	3	FOR 372, Mensuration	3
FOR 361, Silvics	3	PP 318, Forest Tree Diseases	3
ST 311, Statistics	3	Social Science Elective	3
Electives	4	Electives	6
	17		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 321, Scientific Writing	3	FOR 404, Management Plans (camp)	3
FOR 501, Forest Valuation	3	FOR 405, Forest Inventory (camp)	2
FOR 512, Forest Economics	3	FOR 406, Forest Industries (camp)	2
FOR 531, Forest Management	3	FOR 407, Field Silviculture (camp)	2
Electives	6	FOR 511, Silviculture (8 weeks)	3
	18	FOR 532, Forest Management	3
		FOR 553, Forest Photogrammetry (8 weeks)	2
			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 that field.

GENERAL FORESTRY

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 441, Plant Ecology	3	FOR 462, Art Forestation	2
FOR 422, Forest Products	3	MIG 120, Geology	3
FOR 423, Logging Milling	3	RS 301, Rural Sociology	3
FOR 452, Forest Grazing	2		
FOR 472, Policy and Administration	2		
ZO 312, Game Management	3		

FOREST WILDLIFE MANAGEMENT

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 441, Plant Ecology	3	ZO 252, Ornithology	3
FOR 452, Forest Grazing	2	ZO 301, Animal Psysiology	3
ZO 301, Animal Psysiology	3	ZO 522, Animal Ecology	3
ZO 521, Limnology	3	ZO 544, Mammology	3
ZO 551, Wildlife Management	3	ZO 552, Wildlife Management	3

PARKS AND RECREATION

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 411, Plant Ecology	3	BO 403, Systematic Botany	3
MIG 120, Geology	3	PSY 200, Psychology	3
RS 301, Rural Sociology	3	ZO 252, Ornithology	3
SOC 202, Sociology	3	ZO 544, Mammology	3

FOREST NURSERY MANAGEMENT

Fall Semester	*Credits*	*Spring Semester*	*Credits*
AGE 321, Irrigation, Drainage and Terracing	4	SOI 341, Soil Fertility	3
BO 532, Advanced Plant Physiology	2	FC 414, Weed Control	3
ENT 571, For Entomology	3	BO 533, Advanced Plant Physiology	2
GN 411, Principles of Genetics	3	FOR 462, Art Forestation	2
		HRT 301, Plant Propagation	3

GRADUATE OR RESEARCH

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 441, Plant Ecology	3	BO 403, Systematic Botany	3
CH 103, General and Qualitative Chemistry	4	CH 215, Quantitative Analysis	4
MA 211, Analytic Geometry and Calculus B	3	GN 411, Genetics	3
ML Foreign Language	3	MA 212, Analytic Geometry and Calculus C	3
PY 212, Physics	3	MA 215, Finite Math	3
		ML Foreign Language	3

WOOD TECHNOLOGY

Professor R. J. Preston, *Acting Department Head*

Curriculum—The great wood industries which convert wood into thousands of commerical products offer many opportunities for wood technology majors.

The curriculum has been designed to give sound coverage in mathematics and the sciences and to permit sufficient flexibility to enable students to specialize along lines of major interest. At the end of the sophomore year, wood technology students attend a 10-week practicum which is prerequisite to junior standing. At the beginning of the junior year students select an option.

The option in wood products manufacturing trains men for supervisory and production positions in the manufacture of such products as lumber, veneer, plywood, particle board, dimension stock, furniture, cabinets, millwork, and flooring.

The wood products economics and management option stresses the fields of business administration and economics and trains men for careers in merchandising and administration in the wood processing industries, the construction industry, or with material suppliers.

This curriculum leads to the degree of Bachelor of Science in wood technology. A minimum of 151 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

For freshman year see page 146.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 201, General Economics	3	*CH 203, General and Organic Chemistry	4
ENG 231, Basic Speaking Skills	3	FOR 203, Wood Structure and Properties II	3
FOR 202, Wood Structure and Properties I	3	**MA 212, Calculus	3
**MA 211, Calculus	3	**PY 212, General Physics	4
**PY 211, General Physics	4	MS 202, Military Science	
MS 201, Military Science		or	
or		AS 222, Air Science	1
AS 221, Air Science	1	PE 202, Physical Education	1
PE 201, Physical Education	1		
	18		16

* Students planning to elect CH 425, 426, should substitute CH 211 or 215 for CH 203.
** Students who have completed MA 101, 102, should take MA 201, 202, and PY 201, 202.

SUMMER PRACTICUM

First Session Wood Products Practicum Five Weeks	*Credits*
FOR 205-S, Wood Machining Practicum	1
FOR 206-S, Wood Drying Practicum	1
FOR 207-S, Gluing Practicum	1
FOR 208-S, Wood Finishing Practicum	1
FOR 209-S, Plant Inspections	1
	5

Second Session Wood Practicum Five Weeks	*Credits*
FOR 210-S, Mensuration Practicum	2
FOR 211-S, Logging and Milling Practicum	2
FOR 212-S, Graphic Methods	1
	5

JUNIOR YEAR

Fall Semester	*Credits*
EM 311, Mechanics I (Statics)	3
FOR 301, Wood Processes I	4
FOR 512, Forest Economics	3
ST 361, Statistics for Engineers	3
Technical Electives	3
Electives	2
	18

Spring Semester	*Credits*
EM 321, Strength of Materials I	3
ENG 321, Scientific Writing	3
FOR 302, Wood Processes II	4
Technical Electives	3
Electives	5
	18

SENIOR YEAR

Fall Semester	*Credits*
FOR 434, Wood Operations I	3
FOR 521, Wood Chemistry	3
Technical Electives	3
Electives	9
	18

Spring Semester	*Credits*
FOR 435, Wood Operations II	3
FOR 441, Design of Wood Structures	3
FOR 591, Wood Technology Problems	3
Technical Electives	3
Electives	6
	18

Fields of Specialization—At the beginning of the junior year, students with exceptional academic records may, with the approval of the faculty, elect the Honors Program. Other students will elect one of the following options. When an option is chosen the student will select at least two courses from one area of emphasis and at least one course from each of the other two areas of emphasis. The remaining elective hours are to be courses selected by the student in consultation with his adviser to best fit his particular interests.

WOOD PRODUCTS MANUFACTURING OPTION

		Credits
OPERATIONS ANALYSIS	EC 450, Economic Decision Processes	3
	EC 552, Econometrics	3
BUSINESS ADMINISTRATION	EC 310, Economics of the Firm	3
	EC 432, Industrial Relations	3
STATISTICS	ST 515, Experimental Statistics for Engineers	3
	ST 516, Experimental Statistics for Engineers	3

WOOD PRODUCTS ECONOMICS AND MANAGEMENT OPTION

		Credits
ECONOMICS	EC 301, Production and Prices	3
	EC 302, National Income and Economic Welfare	3
	EC 448, International Trade	3
OPERATIONS ANALYSIS	EC 450, Economic Decision Processes	3
	EC 552, Econometrics	3
BUSINESS ADMINISTRATION	EC 310, Economics of the Firm	3
	EC 312, Elements of Accounting	3
	EC 425, Industrial Management	3

PULP AND PAPER TECHNOLOGY

Professor R. G. Hitchings, *Acting In Charge*

Curriculum—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 1956 pulp and paper products were valued at 10.7 billions of dollars and the industry employed more than 400,000 skilled workers in the mills. This is primarily a Southern industry with 60 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 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 required to spend at least one 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 151 credits is required for graduation.

CURRICULUM IN PULP AND PAPER TECHNOLOGY

For freshman year see page 146.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 215, Quantitative Analysis	4	ENG 231, Basic Speaking Skills	3
FOR 202, Structure and Properties of Wood I	3	ENG 321, Scientific Writing	3
*MA 211, Calculus	3	FOR 342, Fiber Analysis	2
*PY 211, General Physics	4	*MA 212, Calculus	3
MS 201, Military Science		*PY 212, General Physics	4
or		MS 202, Military Science	
AS 221, Air Science	1	or	
PE 201, Physical Education	1	AS 222, Air Science	1
Electives	3	PE 202, Physical Education	1
		Electives	3
	19		20

* Students who have completed MA 101, 102 should take MA 201, 202 and PY 201, 202.

SUMMER

	Credits
FOR 491, Forestry Problems, Mill Experience	3

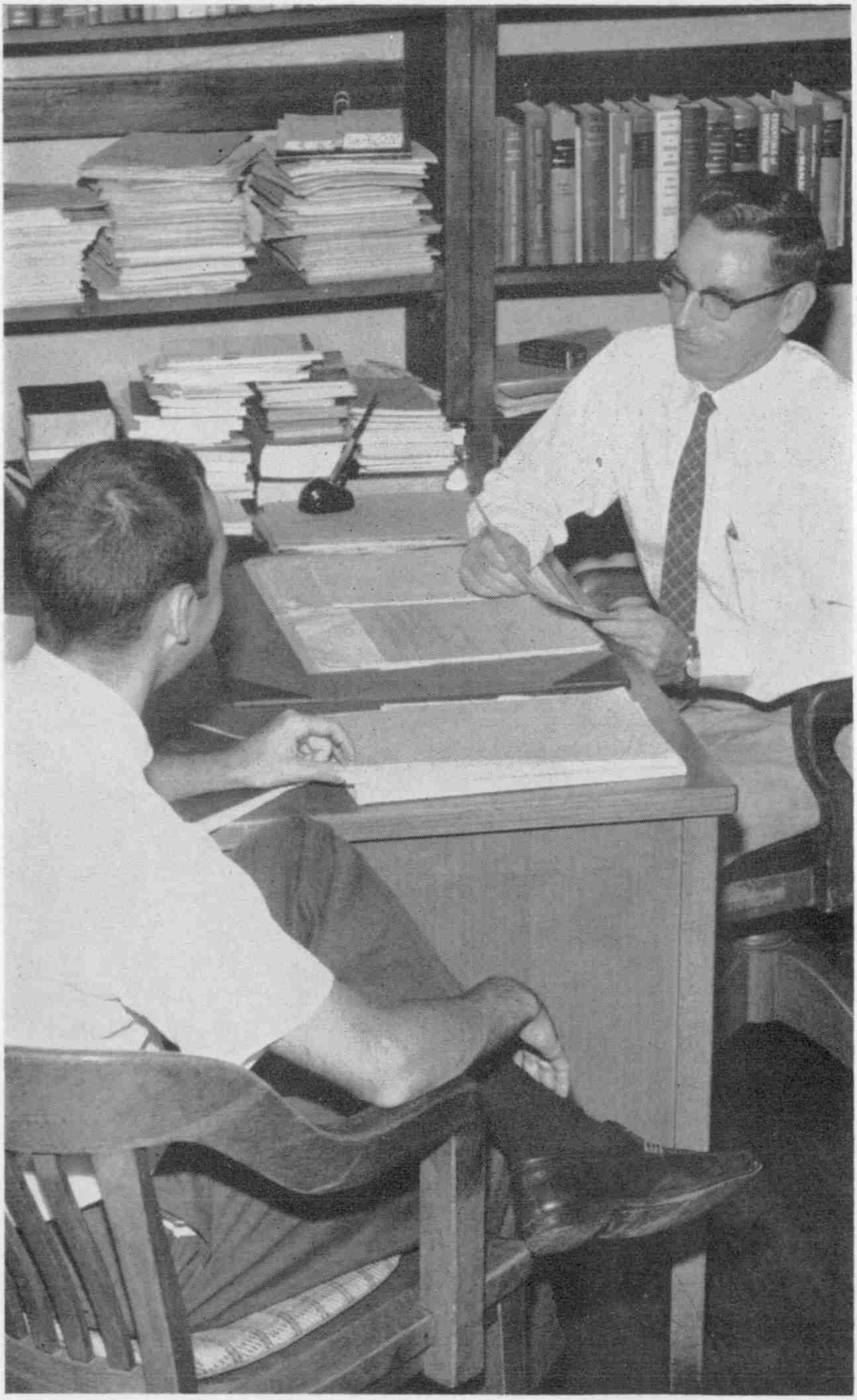
JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CHE 301, Elements of Chemical Engineering	3	CHE 302, Elements of Chemical Engineering	3
CH 341, Physical Chemistry	3	CH 342, Physical Chemistry	3
CH 425, Organic Chemistry	3	CH 426, Organic Chemistry	3
FOR 321, Pulp and Paper Technology	3	EC 201, General Economics	3
ME 304, Fundamentals of Heat Power	3	EE 350, Electrical Applications in Wood Products	3
PSY 200, General Psychology	3	FOR 322, Pulp and Paper Technology	3
Electives	3		
	21		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
FOR 411, Pulp and Paper Mill Equipment	3	FOR 403, Paper Technology Laboratory	3
FOR 413, Paper Testing Laboratory	2	FOR 412, Pulp and Paper Mill Equipment	2
FOR 451, Paper Coloring Laboratory	2	FOR 463, Plant Inspections	1
FOR 461, Paper Converting	1	FOR 482, Pulp and Paper Mill Management	2
FOR 471, Pulp Technology Laboratory	4	FOR 522, Wood Chemistry	3
FOR 521, Wood Chemistry	3	Social Electives	3
Social Science Electives	3	Electives	3
	18		17

School of General Studies



SCHOOL OF GENERAL STUDIES

Fred V. Cahill, Dean

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 in order that each student may pursue further his own interests.

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.

ECONOMICS

Professor Ernst W. Swanson, *Head of the Department*
Professors C. B. Shulenberger, T. W. Wood
Associate Professors A. J. Bartley, Robert L. Bunting, E A. Fails, Cleon Harrell, B. M. Olsen
Assistant Professors Gerald Garb, T. Hardie Park, Ching-Sheng Shen, O. G. Thompson
Lecturers D. R. Dixon, M. A. Hunt
Instructors William R. Hendley, N. E. Piland, William J. Stober, W. A. Walters

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.

ENGLISH

Professor Lodwick Hartley, *Head of the Department*
Professors J. D. Clark, A. M. Fountain, H. G. Kincheloe, R. P. Marshall, John W. Shirley, R. G. Walser
Associate Professors P. H. Davis, E. H. Paget, D. J. Rulfs, A. B. R. Shelley, Jack Suberman, L. H. Swain, L. R. Whichard, R. B. Wynne
Assistant Professors William Barnhart, H. G. Eldridge, R. W. Goldsmith, Max Halperen, Sadie J. Harmon, A. S. Knowles, B. G. Koonce, F. H. Moore, Norwood Smith, Porter Williams, Jr.
Lecturer Hazel Griffin
Instructors Larry Champion, J. B. Easley, Harry Hargrave, C. W. Martin, Jack Porter, Michael Reynolds, Huldah B. Turner, R. B. White

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.

HISTORY AND POLITICAL SCIENCE

Professor Preston W. Edsall, *Head of the Department*
Professors M. L. Brown, Jr., F. V. Cahill, J. T. Caldwell, S. Noblin, L. W. Seegers
Associate Professors L. W. Barnhardt, W. J. Block, A. Holtzman
Assistant Professors B. F. Beers, M. S. Downs, J. L. Helguera, C. F. Kolb, L. F. Reitzer
Instructor O. H. Orr, Jr.

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 intended 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.

MODERN LANGUAGES

Professor George W. Poland, *Head of the Department*
Associate Professor S. T. Ballenger
Assistant Professors F. J. Allred, Ruth B. Hall, Harold L. Titus
Instructor S. Simonsen

The Department of Modern Languages provides instruction in French, German, Spanish, Italian, and Russian as well as special instruction in English for foreign students. It also offers courses in the literature and culture of these language areas.

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 scientific 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 individuals or agencies.

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 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 the student 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.

PHYSICAL EDUCATION

Professor Paul H. Derr, *Head of the Department*
Professor William E. Smith
Professor Emeritus John F. Miller
Associate Professors Harold Keating, John F. Kenfield, Jr., J. B. Edwards
Assistant Professors A. M. Hoch, W. R. Leonhardt, J. H. Little, Frank J. Murray
Instructors J. L. Clements, N. E. Cooper, H. O. Floyd, Jr., W. M. Shea, W. H. Sonner

The purpose of the Department of Physical Education is to make a maximum contributions 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.

SOCIAL STUDIES

Professor George A. Gullette, *Head of the Department*
Professors C. I. Foster, E. M. Halliday, J. R. Lambert, Jr., A. K. F. McKean
Assistant Professors W. F. Edwards R. N. Elliott, Robert S. Metzger
Instructors R. V. Brickell, J. L. Cole

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.

SOCIOLOGY AND ANTHROPOLOGY

Professor Sanford Winston, *Head of the Department*
Associate Professors E. H. Johnson, H. D. Rawls
Assistant Professors Herbert Collins, John W. Tomlin

Courses offered by the department fall into three overlapping areas: courses concerned with the general education of the student; supporting courses in those curricula in which a knowledge of society and human behavior is deemed essential; and courses given in conjunction with other departments which help prepare the student for rather specific types of professional activity upon graduation.

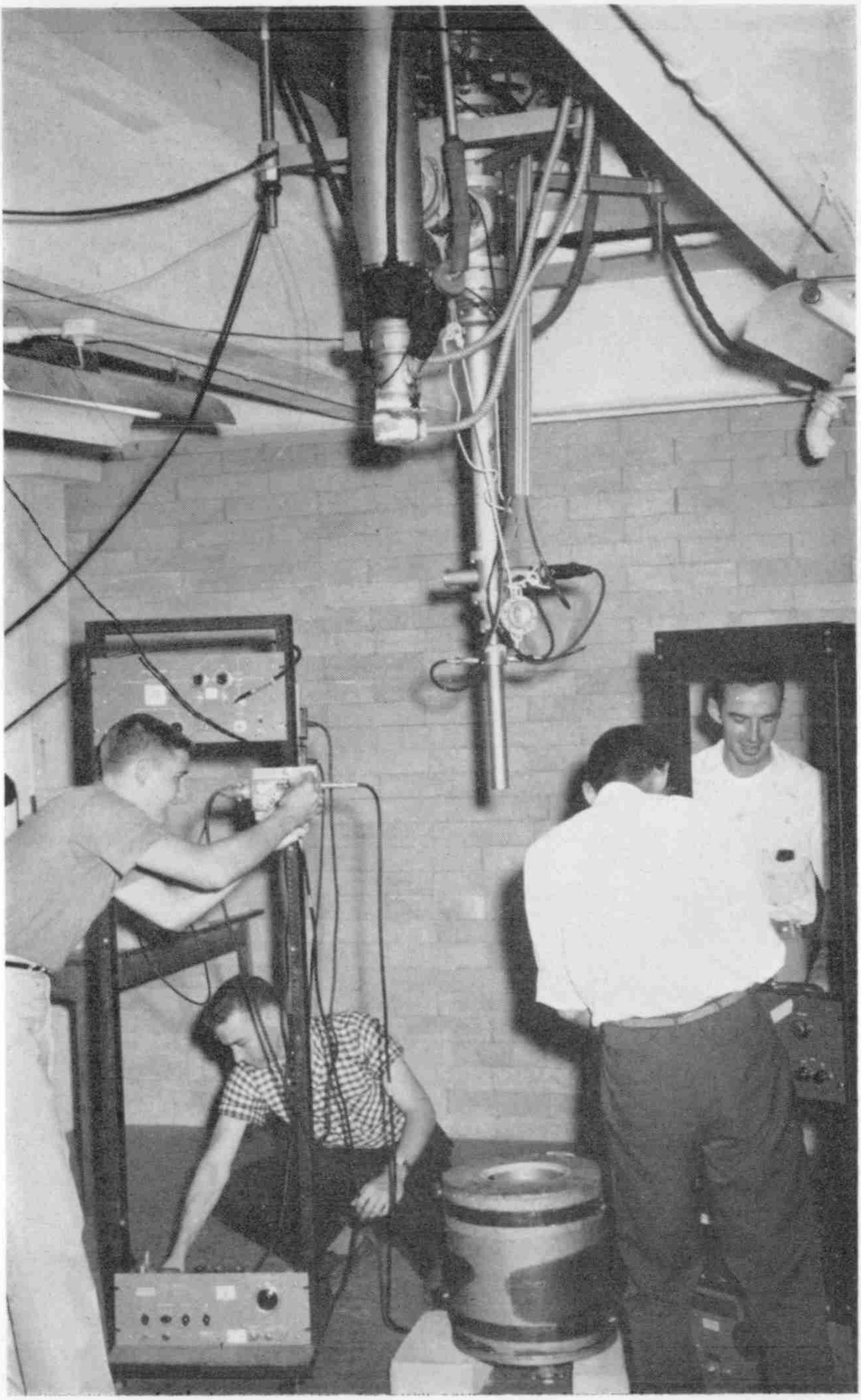
The general objective of courses in the department is to encourage the student as a citizen and as a professional person to see himself as a part of his society. It is believed that the student must understand something of the characteristics and functioning of group behavior within the urban-industrial 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.

THE COLLEGE Union is one of the nation's modern student centers. Among the features of the building are a 160-seat theater, game room, hobby shop, ballroom, private banquet rooms, snack bar, and a main lounge.

College Union

STATE students relax in the College Union's main lounge.

School of Physical Sciences and Applied Mathematics



SCHOOL OF PHYSICAL SCIENCES AND APPLIED MATHEMATICS

Arthur Clayton Menius, Jr., Dean

Carey G. Mumford, Assistant to the Dean

The events of the past several years have re-emphasized the need for an increasing supply of high calibre scientists, mathematicians, and engineers. To serve the state and nation better in the endeavor to produce such outstanding individuals, North Carolina State College formed in 1960 a new School consisting of the Departments of Physics, Chemistry, Mathematics, and Expermiental Statistics. The creation of this school reaffirmed the fact that strong educational and research opportunities in the basic sciences and mathematics are fundamentally necessary and are important adjuncts to successful programs in the applied fields.

Objectives—The School of Physical Sciences and Applied Mathematics has two missions at North Carolina State College: the training of scientists and mathematicians; and the technical support of curricula in agriculture, education, textiles, forestry, design, and engineering.

Facilities—The School of Physical Sciences and Applied Mathematics is fully equipped for instruction and research. Special equipment and laboratories associated with the departments of the school are a complete radiochemistry laboratory; a low power homogeneous reactor and a heterogeneous reactor designed for 100 kw; a one million volt Van de Graaff accellerator; two analog computers, GEDA and Donner; and an IBM 650 digital computer supplemented by access to the Univac 1105 at the University of North Carolina Computation Center at Chapel Hill. Other facilities on the campus available for teaching and research include an RCA electron microscope, complete X-ray laboratories with diffraction and radiographic equipment, and precision instrument shops.

Curricula—It is intended that the undergraduate degree for the school be Bachelor of Science with a major in chemistry, physics, applied mathematics or experimental statistics. The curricula of the Departments of Chemistry, Mathematics, Physics, and Statistics are so arranged as to have essentially a common freshman year. Because of this, a student entering any one of these curricula can, without penalty, change to another department in the School of Physical Sciences and Applied Mathematics during his freshman year. This common year is outlined below.

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, General Inorganic Chemistry	4	CH 103, General and Qualitative Chemistry	4
or		or	
CH 102, General Inorganic Chemistry and	4	CH 104, General and Qualitative Chemistry and	4
CH 102L, General Inorganic Chemistry Laboratory	1	CH 104L, General and Qualitative Chemistry Laboratory	1
ENG 111, English Composition	3	ENG 112, English Composition	3
MA 101, Algebra and Trigonometry	5	MA 102, Analytic Geometry and Calculus I	4
PE 101, Physical Education	1	PE 102, Physical Education	1
MS 101, Military Science I		MS 102, Military Science I	
or		or	
AS 121, Air Science I	1	AS 122, Air Science I	1
Humanities	3	Humanities	3
or	or	or	or
Natural Science	4	Natural Science	4
	17		17

The total number of hours required is to be a minimum of 138 hours which includes 8 hours of Military Science and Physical Education.
Twenty-one semester hours are to be required in the Humanities, exclusive of Freshman English. An additional requirement is one modern language. An Orientation Program for all freshmen is required.

Graduate Study—The Master of Science degree is offered by each department of the school with the doctorate available in physics and statistics. The graduate programs are described in detail in the Graduate School Catalog.

CHEMISTRY

Professor Ralph Clay Swann, *Head of the Department*
Professors Thomas Glenn Bowery, Richard Henry Loeppert, Walter John Peterson, Willis Alton Reid, Cowin Cook Robinson, George Howard Satterfield, Paul Porter Sutton, Samuel B. Tove, Joseph Arthur Weybrew
Associate Professors David Marshall Cates, Alonzo Freeman Coots, Raymond Cyrus White
Assistant Professors Thomas Jacks Blalock, William Prentiss Ingram, Jr., George Gilbert Long, Edward Carroll Sisler
Instructors John Lovell Hall, William Rodgers Johnston, Mrs. Carole Lashinsky, Mrs. Elizabeth Manning, John Wesley Morgan, George Motley Oliver, Mrs. Graye Shaw, Thomas Marsh Ward

Objective—The principal objective is to provide sound basic training in chemistry and the related sciences. Emphasis is placed on aiding and encouraging creative thinking.

Curriculum—The curriculum for the Bachelor of Science degree in chemistry is designed to give the students fundamental training in mathematics and the biological and physical sciences with maximum instruction in chemistry. Graduates in chemistry are provided with a sound foundation for future graduate study.

The curriculum meets the requirements of the American Chemical Society for the training of professional chemists.

CHEMISTRY CURRICULUM

* See page 163 for the freshman curriculum.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 211, Quantitative Analysis	4	CH 212, Quantitative Analysis	4
MA 201, Analytic Geometry and Calculus II	4	MA 202, Analytic Geometry and Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
English	3	English	3
MS 201, Military Science II	1	MS 202, Military Science II	1
or		or	
AS 221, Air Science II		AS 222, Air Science II	
PE 201, Physical Education	1	PE 202, Physical Education	1
	18		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 421, Organic Chemistry	5	CH 422, Organic Chemistry	5
CH 531, Physical Chemistry	3	CH 532, Physical Chemistry	3
CH 531L, Physical Chemistry Laboratory	1	CH 532L, Physical Chemistry Laboratory	1
ML 103, Elementary German	3	ML 104, German Grammar and Prose Reading	3
**Minor	3 or 4	**Minor	3 or 4
	15-16		15-16

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
***Major	3	***Major	3
**Minor	3 or 4	**Minor	3 or 4
****Humanities	6	****Humanities	3
Free Electives	6	Free Electives	10
	18-19		19-20

* Chemistry majors are required to take CH 102, 104 and CH 102L, 104L.
** The Chemistry Department will recognize as a minor four semester courses in the biological sciences, engineering, mathematics, or physics. Any combination of four courses from two of these areas will constitute a "split" minor. The courses applied to a minor should exhibit the applications of chemistry in the areas chosen. This sequence is to be chosen in consultation with the faculty advisor prior to the third year of study.
*** Three of the basic year courses in cheimstry are to be required for admission to the advanced course or courses.
**** If no humanities are taken in the freshman year, a total of 15 credits should be scheduled for the senior year.

EXPERIMENTAL STATISTICS

Professor J. A. Rigney, *Head of the Department*
Professors R. L. Anderson, C. C. Cockerham, R. J. Hader, H. L. Lucas, D. D. Mason, R. J. Monroe, R. G. D. Steel
Adjunct Professors W. S. Connor, A. L. Finkner, G. S. Watson
Professor Emeritus Gertrude M. Cox
Associate Professors A. H. E. Grandage, F. E. McVay, C. H. Proctor, D. R. Shreve, W. W. G. Smart
Assistant Professors W. J. Hall, J. C. Koop (*Visiting*), F. J. Verlinden, T. D. Wallace
Associate Statistician B. B. Bhattacharyya (*Visiting*)
Assistant Statisticians M. A. Cipolloni, W. S. Overton, J. O. Rawlings, B. J. Stines

Statistics is a relatively new and rapidly expanding science. Popular usage of the word "statistics" is to describe "classified facts stated as numbers". The same word is also used or the body of scientific methodology which deals with efficient collection and presentation of data and with the general problem of drawing valid and reliable inferences from data. Early development of statistics occurred in the biological and social sciences. In recent years the use of statistical concepts and methodology has spread into virtually all areas of scientific endeavor, especially the physical sciences and engineering.

The Department of Experimental Statistics is part of the Institute of Statistics which also includes a Department of Biostatistics and a Department of Statistics at Chapel Hill. The Department of Experimental Statistics provides instruction, consultation and computational services on research projects, for other departments of all schools at North Carolina State College, including the Agricultural Experiment Station. Governmental agencies and other institutions use the facilities of the department. The range and quality of the data handled furnish an excellent background for training students in the use of statistical procedures in such fields as the physical, biological 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.

EXPERIMENTAL STATISTICS CURRICULUM

Assuming BO 103 and ZO 103 were elected during the freshman year, a typical program for the succeeding three years might be as follows:

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 201, Calculus I	4	MA 202, Calculus II	4
PY 201, General Physics	5	PY 202, General Physics	5
EC 201, Economics	3	EC 202, Economics	3
Foreign Language	3	Foreign Language	3
MS 201, Military Science	1	MS 202, Military Science	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	17		17

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ST 361, Introduction to Statistics	3	ST 362, Introduction to Statistics	3
MA 301, Differential Equations	3	ST 302, IBM Laboratory	2
PSY 200, Introduction to Psychology	3	Minor	3
ENG 321, Scientific Writing	3	Humanities	3
Minor	3	Free Electives	6
Humanities	3		
	18		17

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ST 521, Basic Statistical Theory	4	ST 522, Basic Statistical Theory	4
ST 515, Experimental Statistics for Engineers	4	ST 516, Experimental Statistics for Engineers	3
Minor	3	Minor	3
Humanities	3	Humanities	3
Free Electives	3	Free Electives	4
	17		17

Graduate—The Department of Experimental Statistics offers work leading to the Master of Science and Doctor of Philosophy degrees. Minor work may be taken in any of the wide variety of research programs on the campus. In addition, a cooperative arrangement with the Departments of Biostatistics and Statistics at Chapel Hill provides for minor work in health affairs and in statistical theory. Active participation in the graduate faculty by several of the staff at the Research Triangle Institute provides further strength of staff and a wider variety of research experience available to graduate students.

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.

MATHEMATICS

Professor John W. Cell, *Head of the Department*
Professors R. C. Bullock, J. M. Clarkson, W. J. Harrington, Jack Levine, G. G. Mumford, H. M. Nahikian, *Graduate Administrator*, H. V. Park, R. A. Struble, J. H. Wahab, H. P. Williams, L. S. Winton
Associate Professors G. C. Caldwell, C. Kassimatis, A. R. Nolstad, D. M. Peterson, H. A. Petrea, H. E. Speece, C. J. Standish (*Visiting*), G. C. Watson
Assistant Professors V. R. Brantley, E. J. Canaday, H. C. Cooke, R. R. Korfhage, C. F. Lewis, C. H. Little, Jr., Morton Lowengrub, R. A. MacKerracher, A. Maltbie, P. Shahdan, J. B. Wilson
Instructors C. N. Anderson, J. W. Bishir, Joyce Caraway, Martha J. Garren, Ruth B. Honeycutt, D. E. Nixon, Carlotta P. Patton, J. L. Sox

Objectives—There is great need 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 mathematically oriented areas.

Curriculum—The curriculum for the Bachelor of Science degrees in applied mathematics is designed to provide the student with a sound foundation in mathematics and at the same time to give him a reasonable acquaintance with some other area of science or engineering. Required courses are relatively few in number so that the individual needs of the student are met more readily. The individual curriculum can be designed either to fit the needs of a student for a position in industry or to provide him a strong foundation for future graduate work.

MATHEMATICS CURRICULUM

For freshman year see page 163.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 201, Analytic Geometry and Calculus II	4	MA 202, Analytic Geometry and Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
ENG 205, Reading for Discovery	3	EC 205, Economic Process	
PE 201, Physical Education	1	or	
MS 201, Military Science II		HI 205, Modern Western World	3
or		PE 202, Physical Education	1
AS 221, Air Science II	1	MS 202, Military Science II	
*Modern Language	3	or	
	—	AS 222, Air Science II	1
	17	*Modern Language	3
			—
			17

JUNIOR AND SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 301, Differential Equations	3	MA 535, Mathematics of Computers	3
MA 511, Advanced Calculus	3	MA 512, Advanced Calculus	3
ST 361, Introduction to Statistics	3	ST 362, Introduction to Statistics	3
***Major	6	***Major	6
****Minor	6	****Minor	6
**Junior, Senior Humanities	6	**Junior, Senior Humanities	6
Free Electives	9	Free Electives	8

It is desirable that MA 511, 512 be taken at the earliest possible time in the junior-senior years.

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* The particular language chosen is subject to the approval of the department head.
** These junior-senior humanities generally should be chosen from humanities offerings at the 300 level and above.
*** To be chosen from mathematics offerings at the 400-500 level.
**** The minor field is, as a minimum, a four course sequence from one other area, and these courses normally should exhibit the application of mathematics in this area. They are not to include any course from this area that is otherwise applied in satisfying the requirements of this curriculum. This minor is to be chosen in consultation with the student's adviser prior to the junior year and this choice is subject to the approval of the department head.

Graduate Study—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 two terms of advanced calculus (or the 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 30 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.

PHYSICS

Burlington Professor Raymond L. Murray, *Head of the Department*
Professors Forrest W. Lancaster, J. S. Meares, A. C. Menius, Jr., R. H. Snyder, Newton Underwood, A. W. Waltner
Visiting Professor Maurice M. Surdin
Associate Professors W. O. Doggett, J. T. Lynn, *Graduate Administrator*, R. F. Stainback
Assistant Professors E. J. Brown, Grover C. Cobb, Jr., William R. Davis, Raoul M. Freyre, D. H. Martin
Instructors E. R. Kirkland, Hubert L. Owen
Director of the Reactor Project E. Jack Story

Objectives—Physics is a fundamental science of observations, measurement and mathematical description of the particles and processes of nature. Included are the classical areas of mechanics, heat, sound, optics, electricity magnetism, plus modern physics, embracing atomic and nuclear particles and phenomena. In addition to the extension of basic knowledge, physics provides an attack on problems of importance in engineering and industrial development.

Opportunities—The demand for graduates with fundamental and specialized knowledge in physics has grown rapidly in recent years. The needs for scientists are currently greatest in the nuclear energy and missile fields, in which large research and development programs are in progress. Positions are available to qualified individuals in government laboratories, industrial research facilities and in universities.

Typical curricula emphasizing physics and nuclear science are outlined below.

PHYSICS CURRICULUM

The freshman year is found in detail on page 163.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 201, General Physics	5	PY 202, General Physics	5
MA 201, Analytic Geometry and Calculus II	4	MA 202, Analytic Geometry and Calculus III	4
Foreign Language	3	Foreign Language	3
Humanities	3	*Minor	4
MS 201, Military Science II or		MS 202, Military Science II or	
AS 221, Air Science II	1	AS 222, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	17		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 407, Modern Physics	3	PY 410, Nuclear Physics I	4
PY 401, Mechanics	4	PY 402, Heat and Sound	4
MA 301, Differential Equations	3	SS 302, Contemporary Civilization	3
SS 301, Contemporary Civilization	3	Mathematics	3
English	3	Free Electives	4
*Minor	3		
	19		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 403, Electricity and Magnetism	4	PY 404, Optics	4
MA 532, Differential Equations II	3	PHI 405, Foundations of Science	3
SS 391, Contemporary Issues	3	Mathematics	3
*Minor	4	Free Electives	6
Free Electives	3		
	17		16

NUCLEAR SCIENCE EMPHASIS CURRICULUM * *

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 201, General Physics	5	PY 202, General Physics	5
MA 201, Analytic Geometry and Calculus II	4	MA 202, Analytic Geometry and Calculus III	4
Foreign Language	3	Foreign Language	3
Humanities	3	Humanities	3
MS 201, Military Science II or AS 221, Air Science II	1	MS 202, Military Science II or AS 222, Air Science II	1
PE 201, Physical Education	1	PE 202, Physical Education	1
	17		17

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 407, Modern Physics	3	PY 410, Nuclear Physics I	4
PY 401, Mechanics or PY 403, Electricity and Magnetism	4	PY 402, Heat and Sound or PY 404, Optics	4
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization	3
MA 301, Differential Equations	3	English	3
Free Electives	4	Mathematics	3
	17		17

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 530, Introduction to Nuclear Reactor Theory	3	PY 520, Physical Measurements in Radioactivity	3
PY 510, Nuclear Physics II	4	PY 518, Radiation Hazards and Protection	3
MA 532, Differential Equations II	3	PHI 401, Foundations of Science	3
SS 491, Contemporary Issues	3	Mathematics	3
Free Electives	6	Minor	3
	19	Free Elective	3
			18

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* If mathematics is the chosen minor, other science courses may be substituted with approval of advisor.

** Major in physics, minor in nuclear science.

Graduate Study—The Department of Physics provides programs of advanced study in applied physics leading to the Master's and Doctor's degrees. A comprehensive understanding of classical and modern physics is stressed with study in either nuclear science or fundamental physics available. The areas of specialization include experimental nuclear and reactor physics, nuclear reactor theory, plasma physics, space propulsion and instrumentation, and the theory of fields. A research thesis is required for both degrees. Research facilities available include a 10-kilowatt heterogeneous reactor, a 100-watt water boiler reactor, a natural uranium subcritical assembly, a one Mev Van de Graaff accelerator and a plasma physics laboratory. Minor work will generally be taken in other departments of the School of Physical Sciences and Applied Mathematics.

School of Textiles


INSTRON

SCHOOL OF TEXTILES

Malcolm E. Campbell, Dean

James W. Klibbe, Academic Coordinator

Food, clothing, and shelter are recognized as the three basic needs of man, and as a corollary 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 value of manufactured products. Furthermore, the textile industry of the state and the area is broadly diversified, ranging from the production of man-made fibers to finished garments, from cotton spinning mills to finishing plants, from woven goods to all types of knitted materials, and from supplies to machine manufacturers.

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 School of Textiles offers several programs at both the undergraduate and graduate levels, in the applied sciences underlying the production and finishing of textile products. Textile research supplements and supports graduate study.

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 four departments: Textile Technology, Knitting Technology, Textile Chemistry, and Textile Research.

Curricula—The School of Textiles offers two basic four-year curricula, textile technology and textile chemistry. After the freshman year these two programs differ; however, there is sufficient similarity in the first year to permit the student to defer the final decision as to his major field of study until the end of the freshman year.

The over-all program of the textile technology curriculum includes course work in the basic sciences and humanities as well as in the professional area of textiles. The arrangement of stems within the curriculum permits for specialization in various areas which lead in one direction to a high concentration of work in the basic sciences and in the other direction to greater depth in the study of economics. The various avenues of selection open to the students are as follows, with specialization as indicated: fiber and yarn technology, fabric technology, general textiles, knitting technology, and textile management.

The latter program provides substantial depth in the fundamentals of economics as well as work in the basic sciences, humanities, and professional textile areas. It is believed that this program provides a firm foundation on which to develop business skills. As with the other programs in textile

technology, the student has further choice within the management program depending on his desire to follow micro, macro, or quantitative economics.

Textile chemistry is designed to give the student a fundamental education in chemistry with special emphasis on the application of this science to textiles.

The textile chemistry curriculum places emphasis on chemical fundamentals so that those students who complete this program with a high degree of excellence are adequately prepared for graduate study either in pure or applied chemistry. Similarly, students who complete the program in any one of the stems in textile technology with a high degree of excellence would be acceptable for graduate study in many different areas.

Inasmuch as the professional work in textiles is concentrated to a great extent in the last two years in the student's program, it is quite possible for students from either junior colleges or other institutions of higher learning to transfer to the School of Textiles with a minimum loss of time.

Degrees—Upon completion of programs in textile technology, the degree of Bachelor of Science in textile technology is conferred. Upon completion of the program in textile chemistry, the degree of Bachelor of Science in textile chemistry is conferred.

The degree of Master of Science in textile technology or of Master of Science in textile chemistry is offered for the satisfactory completion of a minimum 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 coordinate 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 are production of yarns, production of woven and knitted fabrics, dyeing and finishing, industrial engineering, quality control, designing, styling, merchandising, coverting, 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. When possible, trips are arranged for student groups to visit outstanding manufacturing plants. Participation in the trips is required; 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 are offered when a sufficient demand for them develops. 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 (for members of the textile industry) who wish to engage in this type of study. Applications for enrollment in these courses should be mailed direct to Director, College Extension Division, State College Station, Raleigh, North Carolina.

TEXTILE TECHNOLOGY

Professor Elliot B. Grover, *Head of the Department and Textile Research*
Professors J. F. Bogdan, *Director, Processing Research,* D. S. Hamby, B. L. Whittier
Associate Professors W. E. Moser, J. E. Pardue, J. A. Porter
Assistant Professors E. B. Berry, J. W. Klibbe, W. E. Smith, W. C. Stuckey, Jr., R. E. Wiggins
Instructors Ruth B. Guin, James A. King, L. T. Lassiter

Objectives—The purpose of this department is to instruct students in the theory and fundamental concepts, at both the basic and advanced levels, of fiber properties and fiber processing through yarns and fabrics. This is accomplished through the systematic study of the engineering properties of both the materials being processed and of the equipment involved in manufacturing.

Curriculum—The curriculum in textile technology involves a basic education for the first two years in the physical sciences, humanities, and social sciences. After the student has completed this phase of his education, he is then taught the application of the fundamental sciences to the areas of textile technology.

The textile technology curriculum represents a new approach to textile education. It is directed towards a common first year within the school with standardized basic requirements in physical sciences. The major portion of course work in textile technology is deferred to the junior and senior years in order to provide the best possible background for students before entering the major field. The semester credit hours required for graduation have been reduced and at the same time the student has been given a much wider selection of courses in the areas of mathematics, engineering, physics, statistics, economics, and social sciences.

The primary objective of the textile technology curriculum is to provide as general an education as possible and at the same time to prepare the graduate for profitable employment in the textile industry. This is accomplished through an integration of physical sciences and the application of the sciences and economics to the field of textiles.

In addition to the wide selection of basic sciences, the student also has the opportunity for diversification within the School of Textiles. The curriculum offers depth in such selected areas as fiber and yarn technology, fabric technology, knitting technology, general textiles, and textile management.

Graduate Studies—The Department of Textile Technology offers a graduate program leading to a degree of Master of Science in textile technology. This program is designed for students interested in advanced study directed toward individual research and investigations, and is so developed

that students may major in the field of textile technology and minor in approved areas such as statistics, industrial engineering, and textile quality control. A limited number of fellowships and scholarships are available to students who qualify.

Facilities—The facilities of this department are subdivided into respective areas for processing cotton and other short staple fibers; woolen, worsted and long staple synthetic fibers; continuous filament yarns; warp preparation and slashing; cam, dobby, and jacquard weaving; physical testing; and applied research laboratories.

Cotton and Short Staple Synthetics—This area is complete in respect to the most modern of opening, picking, carding, combing, drawing, roving, spinning, winding, and twisting equipment. The laboratory facilities are kept up-to-date, which enables the school to maintain one of the most complete and modern facilities of this type in the world.

Woolen, Worsted, and Long-Staple Synthetic Fibers—A 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 spinning. Another set of machinery in this laboratory is designed to process the longer staple natural and synthetic fibers on the American worsted and new fiber systems. Tow-to-top machines, rectilinear combs, intersecting gills, wide ratch roving and spinning frames, and other supplemental equipment permit the processing of these fibers in many commercially oriented paths into spun yarns.

Continuous Filament Yarns—The continuous filament laboratory has the complete range of equipment necessary for the processing of thrown 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 such as a texturizing machine.

Warp Preparation and Slashing—The equipment for preparing yarn for weaving includes a modern high speed warper, rayon-type slasher, and a small scale experimental slasher, as well as auxiliary equipment. 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.

Cam, Dobby, and Jacquard Weaving—The weaving facilities are subdivided into three laboratories: cam, jacquard, and dobby weaving. On this equipment instruction is given in how to produce such fabrics as print cloths, denims, sateens, ginghams, fancy shirting, dobby weave dress and drapery materials, pile, leno and jacquard fabrics, woven from natural and synthetic fibers. All weave rooms are completely humidified.

Physical Testing—There are three separate air-conditioned laboratories, two of which are used for teaching and undergraduate student work and another for industrial research and graduate student research.

The laboratories contain all equipment for the physical testing of fibers, yarns and fabrics. Included in the equipment are 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, Uster dynamometer, bursting strength testers, drying ovens, abrasion machines, twist testers, hydrostatic pressure tester, automatic reels, permeability testers, eight evenness testers, three Uster spectrographs, and many other types of laboratory equipment, including both commercial and special instruments developed at the school. In addition, the laboratory contains microscopes, cross sectioning devices and equipment for photomicrography. A dark-room containing the necessary equipment for photographic work is also available.

Applied Research Laboratories—Four separate laboratories for applied research in fiber processing and weaving are located in this department. These laboratories are completely equipped and designed for research by students and faculty in the areas of fiber processing, warp preparation and weaving.

KNITTING TECHNOLOGY

Professor William E. Shinn, *Head of the Department and Director, Knitting Research*
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, 54-gauge, and 66-gauge. There is provided also three 400-needle women's nylon hosiery machines 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 pre-boarding, 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 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 eight warp knitting machines of the tricot and raschel types. These machines furnish the basis for instruction in the design analysis, and production of warp knitted fabrics. A collection of fabrics and several winding and warp preparation machines make it possible to process a 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 calendar for finishing knitted tubing, and a fabric brush.

TEXTILE CHEMISTRY

Professor Henry A. Rutherford, *Head of the Department and Director, Chemical Research*
Professor K. S. Campbell
Associate Professors A. C. Hayes, D. M. Cates, *Associate Director, Chemical Research*

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 the Textile Chemistry Department 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.

Graduate Studies—A Master's degree in textile chemistry is offered for the satisfactory completion of one year of graduate study in residence. The program in textile chemistry and its related area, polymer science, is intended to provide professional training at the graduate level. The student with a Bachelor's degree in chemistry or chemical engineering will generally have the academic background to undertake it. The student with a major in physics may desire to enroll in one or two undergraduate courses in chemistry to erase certain deficiencies.

Six courses, that are described elsewhere, (TC 403, 404; TC 511; TC 512; TC 605; and TC 606), are the core of the educational plan at the graduate level. The selection of courses beyond the ones mentioned depends on the student's interest and the nature of his thesis research. The objective is to stimulate basic research and to train scientists in the general field of fiber and polymer chemistry, with proper emphasis on the supporting sciences. Although fiber-forming polymers are emphasized, the program is broad in scope, providing an opportunity for training and research in general principles in the polymer field, as well as advanced study in chemistry, physics, and mathematics.

Fellowships and assistantships are available for qualified students.

Facilities—Facilities available in textile chemistry are as follows:

Dyeing Laboratory—This is a complete laboratory 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 a collection of dyeing and finishing machinery for instructional and experimental purposes. Obtained over the last few years, 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, and a laboratory calendar.

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, wash-fastness, etc., of dyed fibers and fabrics.

TEXTILE RESEARCH

The school is actively engaged in a program of basic and applied research, both state-supported and sponsored, carried on primarily in the educational departments concerned. In textile chemistry, the overall direction is under Professor Henry A. Rutherford, head of the department. Dr. David Cates is the assistant director of chemical research, handling primarily basic areas, and W. R. Martin, Jr., heads the sponsored and applied areas. In the Department of Textile Technology, which encompasses all the areas outside those involved in chemistry and knitting, the overall direction is under Professor E. B. Grover, head of the department, with Professor John F. Bogdan being in direct charge of all sponsored programs. Research in knitting technology is under the direction of Professor W. E. Shinn, head of the Department of Knitting Technology.

MACHINE DESIGN AND DEVELOPMENT

C. M. Asbill, Jr., *Head of Department*

Objectives—The purposes of the 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 manufactures.

And 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.

Also 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

Mrs. Adriana P. Orr, *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 9,000 volumes of which 2,500 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.

TEXTILE PLACEMENT BUREAU

Professor 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 Founrations, 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:

Burlington Industries Professorship of Textiles 1946, Dame S. Hamby, professor of textiles, Department of Textile Technology.

Edgar and Emily Hesslein Professorship of Fabric Development 1948, Benjamin Lincoln Whittier, professor of textiles, Department of Textile Technology.

Chester H. Roth Professorship of Knitting Technology 1948, William Edward Shinn, professor of textiles and head of Department of Knitting Technology.

Abel C. Lineberger Professorship of Yarn Manufacturing 1948, Elliot Brown Grover, professor of textiles and head of Department of Textile Technology.

TEXTILE TECHNOLOGY CURRICULUM

Fiber and Yarn Technology, Fabric Technology, General Textiles, and Knitting Technology Options.

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, Chemistry	4	CH 103, Chemistry	4
*MA 101, Mathematics	5	*MA 102, Mathematics	4
ME 101, Engineering Graphic	2	ENG 112, English	3
ENG 111, English	3	PS 201, American Government	3
TX 181, Introduction to Tex.	1	**Military Science	
**Military Science		or	
or		**Air Science	1
**Air Science	1	**PE 102, Physical Education	1
**PE 101, Physical Education	1		
	17		16

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 201, Physics	5	PY 202, Physics	5
and		and	
MA 201, Calculus	4	MA 202, Calculus	4
or		or	
PY 211, Physics	4	PY 212, Physics	4
and		and	
****Electives for Schedule A.	3	Electives from Schedule A	7
***English	3	TX 281, Fiber Quality	3
HI 252, U. S. History	3	TX 261, Fabric Structure	3
TX 283, Fundamentals of Textiles	2	**Military Science	
**Military Science		or	
or		**Air Science	1
**Air Science	1	**PE 202, Physical Education	1
**PE 201, Physical Education	1		
	19		17
	or		or
	17		19

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
***English	3	Humanities or Economics	3
ST 361, Statistics	3	TX 327, Textile Testing	4
TX 303, Fiber and Yarn Tech.	4	Free Electives	3
TC 201, Textile Chemistry I	2	Stem Hours	8
TX 365, Fabric Technology	4		
TX 342, Knitting Principles	2		18
	18		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
Humanities	3	Social Sciences	3
TX 581, Instrumentation	3	TX 485, Mill Design & Organiz.	3
TC 307, Textile Chemistry	4	Free Electives	6
TX 442, Knitted Fabrics	3	Stem Hours	5
Free Electives	3		17
Stem Hours	3		
	19		

Credits required—freshman year, 33; sophomore year, 36; junior year, 36; senior year, 36; total hours, 141.

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* Students below a selected-cut off point in placement tests in mathematics will take Mathematics, MA 111, 112 and one more hour of free electives. In addition, they must take either Stem 3 or 4.
** 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, students who average C or above on Composition, Eng. 111, 112, may substitute 6 credits of modern language.
**** Students selecting this sequence of courses must re-schedule hours in second semester of sophomore and junior year.

Fiber and Yarn Technology, Fabric Technology, General Textiles, and Knitting Technology Options.

ADDITIONAL STEM REQUIREMENTS

Stem 1 and 2 require the MA 201, 202 sequence.

1. Fiber and Yarn Tech.	*Credits*
TX 304, Fiber & Yarn Tech.	4
TX 436, Staple Fiber Process.	3
TX 430, Cont. Filament Yarns	3
and either	
TX 366, Fabric Technology	4
and	
TX 483, Textile Cost Methods	2
or	
Selection from Schedule B	6, 7, or 8*
	16 (to 18)

2. Fabric Technology	*Credits*
TX 366, Fabric Technology	4
TX 575, Fabric Analytics and Characteristics	3
TX 478, Design and Weaving	3
and either	
TX 304, Fiber and Yarn Tech.	4
and	
TX 483, Textile Cost Methods	2
or	
Selection from Schedule B	6, 7, or 8*
	16 (to 18)

Stems 3 and 4 do not require MA 201, 202 sequence.

3. General Textiles	*Credits*
TX 304, Fiber & Yarn Tech.	4
TX 366, Fabric Technology	4
TX 483, Textile Cost Methods	2
Electives from Schedule C	6
	16

4. **Knitting Technology	*Credits*
TX 483, Textile Cost Methods	2
TX 430, Continuous Filament Yarns	3
TX 441, Flat Knitting	3
TX 444, Garment Manufacture	3
TX 447, 448, Advanced Knitting Lab	4
Transfer to Free Electives	1
	16

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* Any hours above the six allocated may be taken from free electives.
** Either Mathematics-Physics sequence is acceptable.

SCHEDULE A

Schedule A is comprised of two or three-course sequences totaling in each case a minimum of eight semester hours. The sequence elected by the student must meet with the approval of his adviser. Illustrative of the sequences would be studies in the areas of industrial engineering, industrial psychology, economics, or other approved fields of study. Any differences in hours between the minimum of eight which are required and the 10 allocated may be transferred to free electives.

SCHEDULE B

Schedule B is comprised of two-course sequences totaling in each case a minimum of six credit hours. The sequence elected by the student must meet with the approval of his adviser. Illustrative of the sequences would be studies in the areas of mechanics and strength of materials, advanced statistics, advanced physics, industrial engineering, textile quality control, and other approved courses of the 300 level or above in the physical or applied science field.

SCHEDULE C

Schedule C is comprised of two-course sequences in the field of textiles totaling in each case a minimum of six credit hours. Illustrative of the sequences available are the following:

	Credits
TX 436, Staple Fiber Processing	3
and	
TX 430, Continuous Filament Yarns	3
TX 475, Fabric Analytics and Characteristics	3
and	
TX 478, Design and Weaving	3
TX 521, Textile Testing II	3
and	
TX 522, Textile Quality control	3

TEXTILE TECHNOLOGY CURRICULUM

MANAGEMENT OPTION

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101, Chemistry	4	CH 103, Chemistry	4
*MA 101, Mathematics	5	*MA 102, Mathematics	4
ME 101, Engineering Graphics	2	ENG 112, English	3
ENG 111, English	3	PS 201, American Government	3
TX 181, Introduction to Textiles	1	Military Science	
**Military Science		or	
or		**Air Science	1
**Air Science	1	PE 102, Physical Education	1
PE 101 Physical Education	1		16
	17		

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 211, Physics	4	PY 212, Physics	4
MA 201, Mathematics		MA 202, Mathematics	
or		or	
MA 211, Mathematics	4	MA 212, Mathematics	4
HI 252, U. S. History	3	TX 281, Fiber Quality	3
TX 283, Fundamentals of Tex.	2	TX 261, Fabric Structure	3
EC 201, Economics	3	EC 301, Economics	3
**Military Science		**Military Science	
or		or	
**Air Science	1	**Air Science	1
**PE 201, Physical Education	1	**PE 202, Physical Education	1
	18		19

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ST 361, Statistics	3	*** English	3
TX 303, Fiber and Yarn Techn.	4	TX 365, Fabric Technology	4
TC 201, Textile Chemistry I	2	TX 327, Textile Testing	4
EC 302, Economics	3	Free Electives	3
Stem Hours	6	Stem Hours	3
	18		17

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
***English	3	TX 485, Mill Design and Organ.	3
TC 307, Textile Chemistry II	4	EC 490, Senior Seminar in Econ.	3
TX 342, Knitting Principles	2	Free Electives	6
Free Electives	3	Stem Hours	6
Stem Hours	6		18
	18		

Credits required—freshman year, 33; sophomore year, 37; junior year, 35; senior year, 36; total 141.

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* Students below a selected cut-off point in placement tests in Mathemaics will take Mathematics, MA 111, 112 and one more hour of free electives.
** 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, students who average C or above on Composition, English 111, 112, may substitute 6 credits of Modern Language.

ADDITIONAL STEM REQUIREMENTS

5. Micro-Economics

	Credits
EC 312, Accounting for Eng.	3
EC 410, Industry Studies or EC 413, Competition, Monoply and Public Policy	3
Two courses from the following in economics: EC 310, EC 410, or EC 413, EC 440, EC 446, and EC 448	6
Selection from Schedule D	9
	21

6. Macro-Economics

	Credits
EC 312, Accounting for Eng.	3
EC 440, Economics of Growth	3
EC 444, Economic Systems	3
EC 448, International Economics	3
Selections from Schedule D	9
	21

7. Applied Economics

	Credits
EC 312, Accounting for Eng.	3
EC 410, Industry Studies or EC 450, Economic Decision Processes	3
EC 552, Econometrics	3
*MA 405, Introduction to Determinants & Matrices	3
Selections from Schedule D	9
	21

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* Note that MA 202 is a prerequisite for MA 405. Therefore, students taking Stem #7 must take MA 201, 202 rather than MA 211, 212.

SCHEDULE D

Schedule D is comprised of a three-course sequence from one of the following fields totaling in each case a minimum of nine credit hours: English, foreign languages, history, political science, sociology, psychology, natural science, and physical science.

TEXTILE CHEMISTRY CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
TX 181, Introduction to Tex.	1	ENG 112, English	3
ENG 111, English	3	CH 104, Chemistry	4
CH 102, Chemistry	4	MA 102, Mathematics	4
MA 101, Mathematics	5	TX 283, Fundamentals of Tex.	2
ME 101, Engineering Graphics	2	PS 201, American Government	3
*Military Science		*Military Science	
or		or	
*Air Science	1	*Air Science	1
*PE 101, Physical Education	1	*PE 102, Physical Education	1
	17		18

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 211, Calculus	3	MA 212, Calculus	3
PY 211, Physics	4	PY 212, Physics	4
CH 211, Quantative Analysis	4	HI 252, U. S. History	3
TX 261, Fabric Structure and Design	3	CH 212, Quantative Analysis	4
		TX 281, Fiber Quality	3
*Military Science		*Military Science	
or		or	
*Air Science	1	*Air Science	1
*PE 201, Physical Education	1	*PE 202, Physical Education	1
	16		19

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
**English Elective	3	**English Elective	3
Humanities or Economics	3	or	
CH 421, Organic Chemistry	5	Humanities or Economics	3
TX 327, Textile Testing	4	CH 422, Organic Chemistry	5
TC 303, Textile Chemistry III	3	TC 304, Textile Chemistry III	3
	18	Electives	3
			17

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
TX 581, Instrumentation	3	Humanities or Social Science	3
TC 403, Texitle Chem. Tech.	5	TC 404, Tex. Chem. Tech.	5
TC 511, Chemistry of Fibers	3	CH 342, Physical Chemistry	
CH 341, Physical Chemistry		or	
or		CH 532, Physical Chemistry	3
CH 531, Physical Chemistry	3	CH 532L, Physical Chemistry Laboratory	1
CH 531L, Physical Chemistry Laboratory	1	Electvies	6
Electives	3		18
	18		

Credits required—freshman year, 35; sophomore year, 35; junior year, 35; senior year, 36; total 141.

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* 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, students who average C or above on Composition, English 111, 112 may substitute 6 credits of Modern Language.

THE GRADUATE SCHOOL
NORTH CAROLINA STATE COLLEGE

Donald B. Anderson, Vice-President, Graduate Studies and Research, Chapel Hill

Walter J. Peterson, Dean, Raleigh

The Graduate School of the Consolidated University of North Carolina is composed of three divisions, one at each of the three institutions of the University. 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 fields in agriculture, engineering, forestry, 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 psysiology and ecology), ceramic engineering, chemical engnieering, civil engineering, electrical engineering, engineering physics, entomology, experimental statistics, field crops, forestry, genetics, mechanical engineering, nuclear engineering, plant pathology, rural sociology, soils, and 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 15 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 also has 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 also are taken to various communities where the demand is sufficiently great and others are conducted at military bases in the state.

The Extension Division conducts a series of night 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, sawmill operators, seedsmen, pest control operators, clay plant operators, gas plant operators, dry kiln operators, nurserymen, freezer plant operators, cemetery superintendents, artificial breeders, farm managers, and many others.

Among the other courses offered annually are those of 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 workship, aerial photo interpretation, commercial flower growers, linear programming, warm air heating and air conditioning, beef production, state garden schools.

Other programs offered are dairy production, dairy manufacturing, field crops production, dairy herd testing, 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 courses 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 12 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:

Mr. Edward W. Ruggles
Division of College Extension
North Carolina State College
Raleigh, North Carolina

MILITARY TRAINING

DEPARTMENT OF MILITARY SCIENCE

Professor of Military Science Colonel L. W. Merriam
Assistant Professors of Military Science Lieutenant Colonel Donald J. McGurk, Lieutenant Colonel John K. Roberts, Jr., Lieutenant Colonel Wilford L. Willey, Major James F. Barrett, Major Joseph W. Jenkins, Major Edwin M. Reid, Major Oliver M. Smith, Captain Max A. Craig, Captain Norman G. Eriksen, Captain Charles L. McLain

DEPARTMENT OF AIR SCIENCE

Professor of Air Science Colonel Robert C. Paul
Assistant Professors of Air Science Major Emmett H. Miller, Jr., Major Tommy Cobb, Major Maynard C. Cusworth, Major Earl R. Dickey, Captain William S. Clarke, Jr., Captain Kendall G. Lorch, Captain Claude R. Rowell, Captain Charles W. Rowan, Captain Gerald L. Waterman

Objectives—The Reserve Officers' Training Corps (ROTC) at State College designates those students enrolled for training in the Department of Military Science 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 professors of military science (PMS) and professor of air science (PAS). 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 designed as assistant professors of military science; 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 freshman and sophomores unless they are excused by the college administration. (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.)

The college provides, in co-operation 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 Federal Aviation Agency pilot's certificate. 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—The satisfactory completion of the first year of the Army ROTC course is a prerequisite for entering the second year. Enrollment in advanced courses is elective on the part of the student. The selection of advanced course students 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 PMS 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. An elective subject is chosen from general academic areas in effective communication, science comprehension, general psychology, or political development and political institutions for utilizing in the junior and senior years.

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-veterans 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 foundations of air power, Air Force officer development, leadership, and air power concepts. The Air Force ROTC curriculum is designed to prepare the student for his obligations of citizenship to his country as an officer in the United States Air Force or as a civilian.

Uniforms and Equipment—Officer-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 either Army or 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.

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

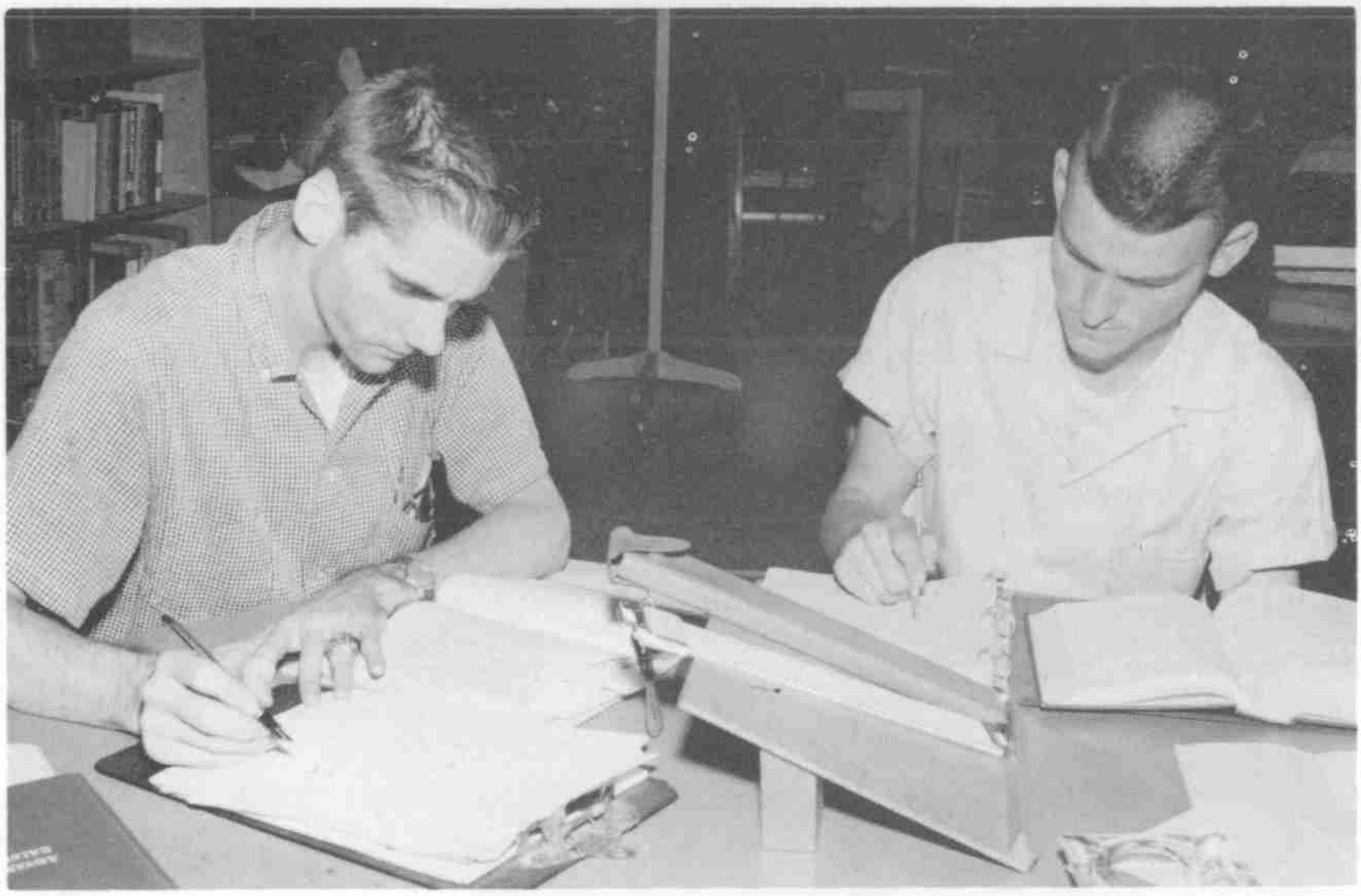
Army—The Army ROTC unit at State College consists of an Army brigade and a drum and bugle corps. The Army brigade, commanded by a cadet colonel and staff, consists of a provisional batallion and three battle groups. The cadet colonel and all other cadet officers are selected from students enrolled in 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 also are 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 staff 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 Army 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 and 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 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; 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 four 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."

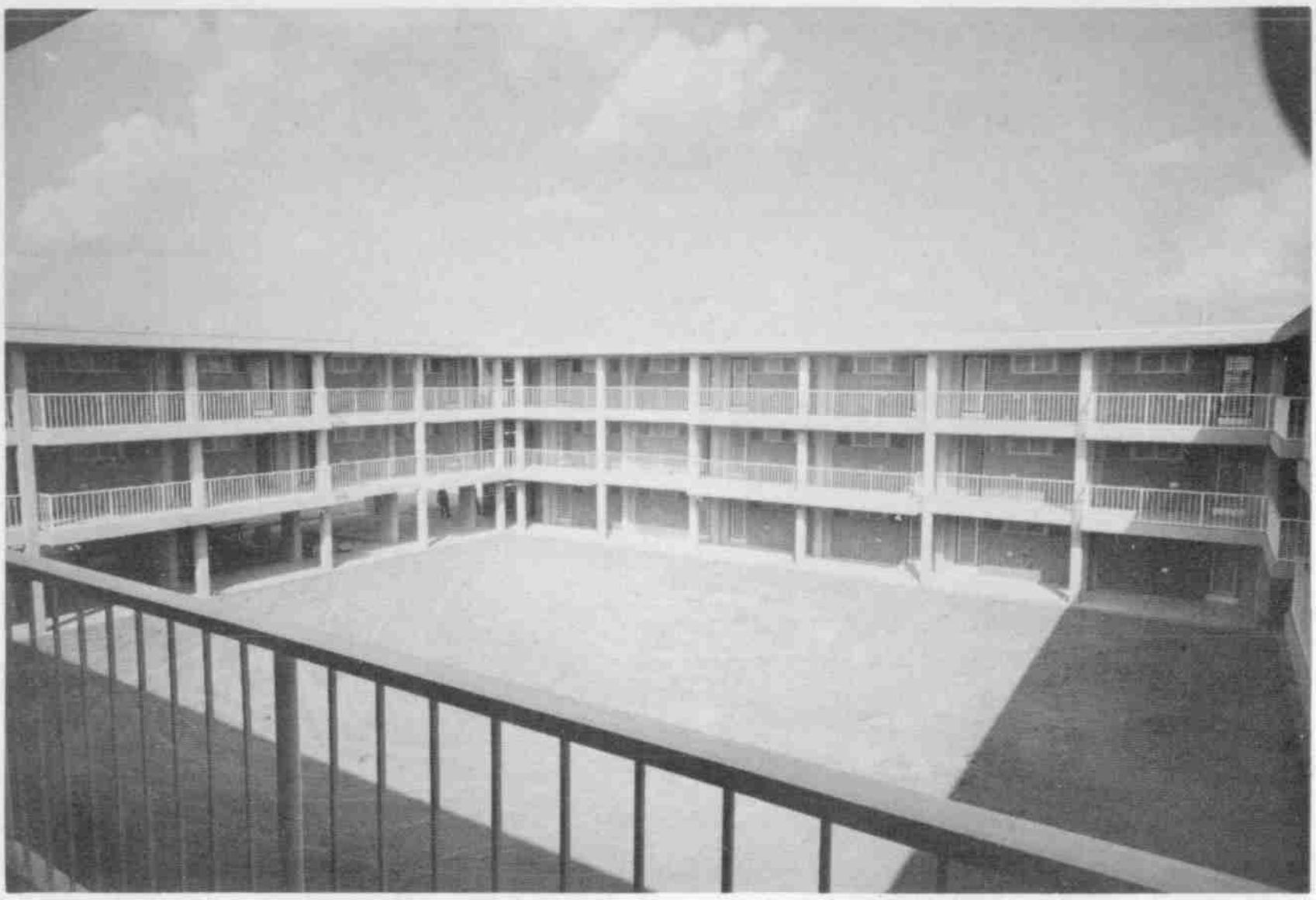


STUDENTS find the library an ideal place for studying.

The College Library

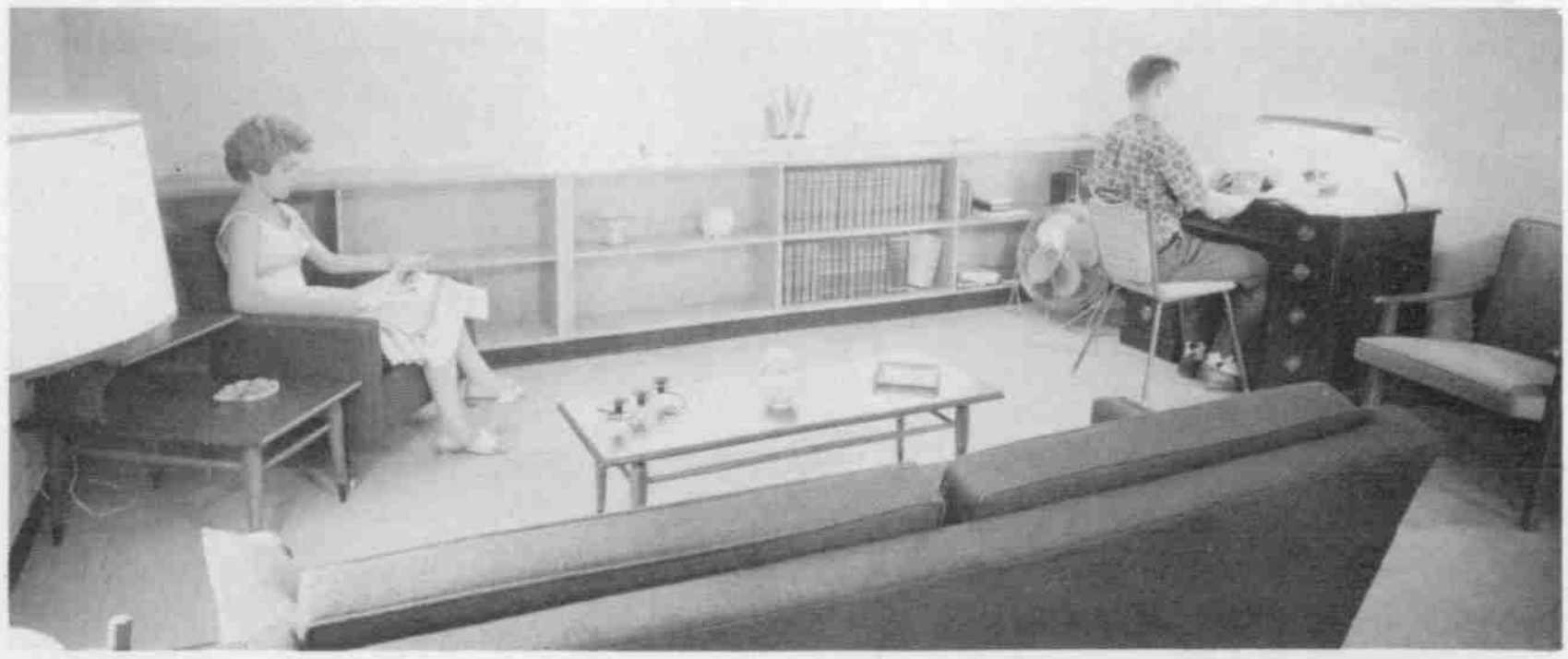
D. H. HILL Library was named in memory of the late Dr. Daniel Harvey Hill, State College's third president. At present the library's book collection numbers more than 212,000 volumes plus numerous journals and documents.

Course Descriptions



THE MARRIED STUDENT housing center is one of State College's newest additions. The attractive 300-unit center is valued at $2,200,000. Included in the center are 120 efficiency, 148 one-bedroom, and 32 two-bedroom apartments. A group of the efficiency units are shown here.

Married Student Housing Center



THE ATTRACTIVE ROOMS in the married student housing center provide ample space for study and relaxation for the occupants.

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 and marketing; organization for production in agriculture; consumers and their influence upon the demand for agricultural products; relationships between agriculture and other segments of the economy; dynamic factors in the economy which affect agriculture.
Staff

AGC 303 ORGANIZATION AND BUSINESS MANAGEMENT OF FARMS **3 (2-2) f s**
Prerequisite: AGC 212
This course is desgined 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 attenton is given to problems of mechanization, leasing arrangements, credit financing, and labor management. Also, training in the use and analysis of farm records as an aid to better business management in planning adjustments is provided.
Messers. Pierce and Hoover

AGC 311 ORGANIZATION AND BUSINESS MANAGEMENT OF MARKETING FIRMS **3 (2-2) f s**
Prerequisite: AGC 212
A study of the agricultural marketing system and the current economic forces affecting its structure and efficiency; decision-making by agricultural business firms, with some discussion of integration and inter-firm relationships; effects of monopoloy in marketing relative to government policies of control. Classroom discussion is supplemented by visits to marketing firms and by practical problems illustrating firm decisions. A laboratory period will be included in alternate weeks beginning with the second full week of classes.
Staff

AGC 322 ORGANIZATION AND MANAGEMENT OF COOPERATIVES **2 (2-0) f**
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.
(Offered in Spring 1962 and alternate years) 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 firms which deal in the marketing process of these major cash crops. 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. A laboratory period will be included in alternate weeks beginning with the second full week of classes.
Staff

AGC 352 MARKETING POULTRY PRODUCTS **3 (2-2) s**
Prerequisite: AGC 212
A study of marketing principles with practical application related to poultry and poultry products; factors affecting prices and price variability in these products; the effects of changes in technology and institutional arrangements involved such as contract agreements; organization and efficiency of processing, assembling and distribution systems. A laboratory period will be included in alternate weeks beginning with the second full week of classes.
Mr. Stemberger

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*In a typical course description, the semester hours of credit, the number of actual lecture and laboratory hours of meeting per week, and the term or terms in which the course is offered are shown in this manner: 2(1-2) f s. The 2 indicates the number of semester hours credit given for satisfactory completion of the course. The (1-2) indicates that the course meets for one hour of lecture and for two hours of laboratory work each week. And the f s indicates that the course may be taken either during the fall or the spring semester.

AGC 362 MARKETING DAIRY PRODUCTS **3 (2-2) 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 government regulation of milk and milk products.
(Offered in fall 1962 and alternate years) Mr. Simmons

AGC 364 MARKETING FRUITS AND VEGETABLES **3 (2-2) s**
Prerequisite: AGC 212
Introduction to marketing with illustrations and particular application to friuts and vegetables; buying and selling decisions faced by farmers; supply and demand characterstics of principal fruits and vegetables; the organization and business management of markets; methods of marketing; pricing and price discrimination; relation of the processing industry to firms marketing fresh products; the role of government in establishing grades and standards, provision of inspection services and establishment of marketing orders and agreements. A laboratory period will be included in alternate weeks beginning with the second full week of classes.

Mr. King

AGC 372 MARKETING LIVESTOCK **3 (2-2) 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 it faces, the nature of these problems and the manner in which they may best be solved. A laboratory period will be included in alternate weeks beginning with the second full week of classes.

Staff

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, and (3) methods of determining when and how credit can be used effectively by farmers; special problems associated with agricultural credit.

Mr. Hoover

AGC 431 AGRICULTURAL PRICE ANALYSIS **3 (3-0) f**
Prerequisite: AGC 212
This course involves an examination and analysis of agricultural price behavior as related to decision-making of economic units. Methods of agricultural price analysis, including construction and use of index numbers and measure of price movements, are studied. Essential elements of theory will be introduced to show how and why prices change so frequently and persistently. Emphasis is placed upon the interpretation of price information in relation to income, production and consumption of farm products. Special attention is given to marketing practices which influence price formation for agricultural products, including storage operations, time and space factors.

Messrs. Pierce, Hoover

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

AGC 501 (EC 501) INTERMEDIATE ECONOMIC THEORY **3 (3-0) f s**
Prerequisite: AGC 212 or equivalent
An intensive analysis of the determination of prices and market behavior, including demand, costs and production, pricing under competitive conditions, and pricing under monopoly, and other imperfectly competitive conditions.

Staff

AGC 512 ECONOMIC ANALYSIS OF FACTOR MARKETS **3 (3-0) s**
Prerequisite: AGC 212
This course is oriented to the relative significance of land, labor, and capital as factors of production in a modern agricultural economy, including major changes in the respective roles of these factors of production in recent years. An examination is made of the changes in characteristics of the supply and demand for these factors. The structure and efficiency of markets for these factors, including relevance of the institutional and attitudinal setting in each type of market and nature of the demand-supply equilibration will be investigated. Public policies as they affect efficiency of the factor markets and other goals relating to the use of the basic factors of production in agriculture also will be considered.

Mr. Tolley

AGC 521 PROCUREMENT, PROCESSING AND DISTRIBUTION OF AGRICULTURAL PRODUCTS **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 of increasing the efficiency of marketing agricultural products.

Mr. King

AGC 523 PLANNING FARM AND AREA ADJUSTMENTS **3 (2-2) f**

Prerequisite: AGC 303 or equivalent

The application of economic principles in the solution of production problems of typical farms in the state; methods and techniques of economic analysis of the farm business; application of research findings to production decisions; development of area agricultural programs.

Mr. Coutu

AGC 533 AGRICULTURAL POLICY **3 (3-0) s**

Prerequisite: AG 212

A review of the agricultural policy and action programs of the Federal Government in their economic and political setting; analysis of objectives, principal means, and observable results under short-term and long-term viewpoints, and under the criteria of resource use and income distribution within agriculture, and between agriculture and the rest of the economy; appraisal of alternative policy proposals; the effects of commodity support programs on domestic and foreign consumption; investigation of some of the international aspects of United States agricultural policy; attempts at world market regulations and the role of international organizations, agreements and programs.

Staff

AGC 551 AGRICULTURAL PRODUCTION ECONOMICS **3 (3-0) f**

Prerequisite: AGC 212

An economic analysis of agricultural production, including production functions, cost functions, programming and decision-making principles; and the application of these principles to farm and regional resource allocation, and to the distribution of income to and within agriculture.

Mr. Toussaint

AGC 552 CONSUMPTION, DISTRIBUTION AND PRICES IN AGRICULTURE **3 (3-0) s**

Prerequisite: AGC 212 or equivalent

Basis for family decisions concerning consumption of goods and services and supply of productive factors; forces determining prices and incomes; interrelationships between economic decisions of the household and the firm.

Mr. Henry

AGC 561 SEMINAR IN CONTEMPORARY ECONOMIC PROBLEMS IN AGRICULTURE **Maximum 6**

Prerequisites: Senior or graduate standing and consent of the 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. This course usually is reserved for seniors majoring in Agricultural Economics or graduate students interested in special problems suggested by the course outline of their academic program of the degree involved.

Staff

GRADUATE STUDENTS ONLY

AGC 602 MONETARY AND FISCAL POLICIES IN RELATION TO AGRICULTURE **3 (3-0) s**

Prerequisite: AGC 501 or equivalent

Aggregative theory relevant to monetary and fiscal policies; fundamentals of model building; mathematical models involving income, employment, price levels, money supply, interest rates and other aggregative variables; main economic magnitudes for the United States economy; the structure of taxes and revenue; institutional determinants of monetary and fiscal operations in the United States; and the relation of monetary-fiscal policies to agricultural incomes and prices.

Mr. Tolley

AGC 612 INTERNATIONAL TRADE IN RELATION TO AGRICULTURE **3 (3-0) s**

Prerequisite: AGC 602

The principles of international and interregional trade; structures of trade relationships between countries engaged in the import or export of agricultural products; attempts at stablizing trade and financial transactions.

Mr. Tolley

AGC 621 RESEARCH IN AGRICULTURAL ECONOMICS **Maximum 6 f s**

Prerequisites: 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 analysis, inductive and deductive methods of research, selection of projects, planning and execution of the research project.

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. Lindsey

AGC 632 WELFARE EFFECTS OF AGRICULTURAL POLICIES AND PROGRAMS **3 (3-0) f**

Prerequisite: AGC 642
Description 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**

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.

Mr. Seagraves

AGC 642 ECONOMICS OF CONSUMPTION, DEMAND AND MARKET INTERDEPENDENCY **3 (3-0) s**

Prerequisites: AGC 641, ST 511 or equivalent
An advanced study in the theory of, and research related to, 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**

Prerequisites: ST 521, 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**

Prerequisites: ST 522, 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 multivariates analysis; techniques for analysis of time series.

Graduate Staff

AGC 671 ANALYSIS OF ECONOMIC DEVELOPMENT IN AGRICULTURE **3 (3-0) f**

Prerequisite: AGC 641
A theoretical and empirical study of the processes of economic growth; the problems of underdeveloped countries; the role of agriculture in a developing economy; an examination of policies and programs needed for effective economic development.

Mr. Maddox

AGRICULTURAL ENGINEERING

COURSES FOR UNDERGRADUATES

AGE 151, 152 FARM MECHANICS **2 (2-2) f s**

Prerequisite: Enrollment in ASE or ATE curriculum
These courses are designed to acquaint Agricultural Engineering students with materials and tool processes related to the various fields of endeavor in Agricultural Engineering; also to develop the student's ability to plan in terms of the manual and managerial skills related to the utilization of such materials and processes.

Mr. Blum

AGE 201 AGRICULTURAL CONSTRUCTION AND MAINTENANCE I **2 (1-3) f s**

This course is designed to acquaint the student with planning procedures, construction materials and woodworking tools, building layout and design, and preventative maintenance. Limited laboratory practice in the manual and managerial skills involved in the utilization of such information is included.

Messrs. Howell, Blum

AGE 202 AGRICULTURAL CONSTRUCTION AND MAINTENANCE II **2 (1-3) f s**
This course is designed to acquaint the student with the manual and managerial skills involved in the construction, repair, and maintenance of farm machinery and utilities. The use of materials, tools, and facilities needed will be stressed. Considerable emphasis will be placed on arc and oxyacetylene welding.

Messrs. Howell, Blum

AGE 211 FARM POWER AND MACHINERY I **3 (2-2) f s**
Corequisite: PY 201 or PY 211 for ASE or ATE students
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, Howell

COURSES FOR ADVANCED UNDERGRADUATES

AGE 303 ENERGY CONVERSION FOR AGRICULTURAL PRODUCTION **2 (2-0) s**
Prerequisites: BO 103 or ZO 103, MA 112 or MA 201, PY 211 or PY 201
Energy transformations and exchanges of plants and animals are studied on the basis of physical theories and principles. Specific examples in thermal radiation, convection, conduction, phase changes, muscle work, photosynthesis, respiration, and concentration of solutions will be discussed.

Mr. Suggs

AGE 321 IRRIGATION, DRAINAGE AND TERRACING **3 (2-3) f s**
Prerequisite: CE 201 for ATE students
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. Sewell

AGE 331 POWER HEATING, REFRIGERATION **3 (2-2) s**
Prerequisite: PY 211
Fundamentals of power application in the processing and preservation of perishable food products.

Mr. Weaver

AGE 332 FARM BUILDINGS AND CROP PROCESSING **3 (2-3) f**
Prerequisite: EM 341 for ATE students
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.

Messrs. Blum, Weaver

AGE 341 FARM ELECTRIFICATION AND UTILITIES **3 (2-2) f**
Prerequisite: Junior standing
Problems and general study in the proper selection and use of applicable farm electric equipment and allied utilities.

Mr. Weaver

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

AGE 401 PROBLEMS IN FARM MECHANICS **3 (2-2) f s**
Prerequisites: AGE 201, 202 Enrollment in Agricultural Education
A study of the mechanical activities engaged in by the vocational agriculture teacher; with emphasis on the role of the teacher in the area of agricultural engineering technology. Included is a study of facilities, equipment, and shop management.

Mr. Howell

AGE 411 FARM POWER AND MACHINERY IIB **3 (2-3) s**
Prerequisite: AGE 211
This course is designed to provide students in Agricultural Engineering Technology 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.

Messrs. Fore, Greene

AGE 451 CONDITIONING PRINCIPLES FOR PLANT AND ANIMAL SYSTEMS **2 (1-2) f**
Prerequisite: ME 301
Principles of heat transfer and diffusion are presented using the mathematical equations to point out analogous systems. The use of electric analogs to describe thermal and diffusion fields is demonstrated. Psychrometric and heat transfer principles are used to indicate methods of conditioning the environment in agricultural structures. Thin layers drying theory and dimensional analysis are used to describe bulk drying systems of agricultural crops.

Mr. Jordan

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. Hassler

AGE 462 FARM POWER AND MACHINERY IIA **4 (3-3) f**
Prerequisites: AGE 211, EM 321
A study of engineering analysis as it applies to problems in the power and machinery field of Agricultural Engineering. The course is intended to strengthen the students ability to approach agricultural engineering problems in a systematic manner.

Mr. Bowen

AGE 481 AGRICULTURAL STRUCTURES AS PRODUCTION UNITS **4 (3-3) s**
Prerequisites: AGE 451, EM 321
Application of conditioning principles to provide the required environment for optimum agricultural production is stressed. Environmental requirements of animals and of harvested crops are discussed. Analysis for labor reduction and the replacement of human decisions with electric controls are indicated. Environmental requirements, proper arrangement, equipment, equipment selection and control, and estimation of external loads are presented to indicate the design procedures for a sound, functional building. A term report of the student's choice is required to demonstrate his comprehension of the underlying principles of the problem, and also to test his ability to express himself.

Mr. Jordan

AGE 491 RURAL ELECTRIFICATION **4 (3-3) f**
Prerequisite: EE 320
Wiring and circuitry for both single and three phase applications of electricity to farm and rural community processes and operations. A very brief study of the local and regional organization as developed by the electric industries for the dependable generation, transmission, and distribution of power. Electric motor characteristics and selection are studied in the laboratory along with those of water systems, feed grinders and mixers; lighting systems, cooling, ventilating, heating, and the application of switches and controls.

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. Hassler, Staff

AGE 552 INSTRUMENTATION FOR AGRICULTURAL RESEARCH AND PROCESSING **1 (0-2) f or s**
Prerequisites. EE 320, MA 401
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 miximum of six credits is allowed towards a Masters Degree; no limitation on credits in Doctorate program.

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.

Graduate Staff

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, 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 103 INTRODUCTION TO AGRICULTURE **1 (0-2) f**
A study of Agriculture as a profession and as it relates to the entire economy of the United States.

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) s**
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

AIR SCIENCE

THE BASIC COURSE

AS 121 AIR SCIENCE I **1 (0-1) f**
During the fall semester, each student will be required to participate in the Leadership Laboratory program for one hour per week. Classroom requirements will be met by the satisfactory completion of at least three academic hours of an approved course in the field of mathematics, modern languages or humanities.

AS 122 AIR SCIENCE 1 **1 (2-1) s**
During the spring semester, each student will attend a two hour per week class under the Air Science Department for instruction in foundations of air power including the subjects of the military instrument of national security, elements and potentials of air power, Evolution of aerial warfare and Air Vehicles and principles of flight. In addition, one hour per week will continue to be devoted to the leadership laboratory program.

AS 221 AIR SCIENCE 2 **1 (2-1) f**
Continued study in foundations of air power dealing with the subjects of evolution of aerial warfare, elements of aerial warfare, employment of Air Forces and space operations. Leadership laboratory training for one hour per week will be required in addition.

AS 222 AIR SCIENCE 2 **1 (0-1) s**
Leadership laboratory will continue, however, the classroom requirements will be met by satisfactory completion of at least three academic hours of an approved course in the fields of physical or natural sciences, or in the intermediate levels of mathematics, modern languages, humanities or social sciences.

THE ADVANCED COURSE

The leadership laboratory program continues for one hour per week throughout the advanced course with students assuming command and control of progressively larger units and greater responsibilities.

AS 321 AIR SCIENCE 3 **1 (2-1) f**
Prerequisites: Air Science 1 and 2 or equivalent credit.
Instruction deals with the Air Force Commander and his staff, creative problem solving and the leadership laboratory. Classroom requirements will be partially met by the satisfactory completion of either SOC-301, SOC-501, or EC-426.

AS 322 AIR SCIENCE 3 **2 (3-1) s**
Instruction is given in the military justice system, communicating and instructing in the Air Force and leadership laboratory.

AS 421 AIR SCIENCE 4 **1 (3-1) f**
Prerequisites: Air Science 3 and AFROTC Summer Training.
Instruction deals with weather and navigation, a flying instruction program, a study of the military aspects of world political geography and the leadership laboratory.

AS 422 AIR SCIENCE 4 **2 (2-1) s**
A study of the military aspects of world political geograph, a briefing for commissioned service and the leadership laboratory. Classroom requirements will be partially met by the satisfactory completion of one of these courses: PS-302, HI-415, SS-301, SS-302, SS-491, SS-492.

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.
Staff

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. Goode

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 (2-3) s**
Prerequisite: CH 451
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, 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**
Prerequisites: CH 431, ZO 301
Fundamentals of modern animal nutrition, including classification of nutrients, their general metabolism and roles in productive functions.
Mr. Ramsey

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 industry.
Mr. Hyatt

AI 407 ADVANCED LIVESTOCK PRODUCTION **4 (3-3) s**
Prerequisites: GN 411, AI 312
A study of the economic, nutritional, genetic, physiological and managerial factors affecting the operation of commercial and purebred livestock enterprises.
Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES*

AI 407 ADVANCED LIVESTOCK PRODUCTION **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 (GN 503) GENETIC IMPROVEMENT OF LIVESTOCK **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. Robison

AI 505 DISEASES OF FARM ANIMALS **3 (3-0) f**
Prerequisites: CH 101, CH 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 **Maximum 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 (GN 602) POPULATION GENETICS IN ANIMAL IMPROVEMENT **3 (Arranged) f**
Prerequisites: ST 512, GN 512
A study of the forces influencing gene frequencies, inbreeding and its effects, and alterative 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 604 EXPERIMENTAL ANIMAL PHYSIOLOGY **4 (2-4)**
Prerequisite: ZO 513 or equivalent
A study of the theories and techniques involved in the use of animals in physiological investigation.

Messrs. Ulberg, Thomas, Wise

AI 614 (BO 614) BACTERIAL METABOLISM **3 (2-3) 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, 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; meabolic energy relationships.

Mr. Tove

AI 622 (CH 622, ST 622) PRINCIPLES OF BIOLOGICAL ASSAYS **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.

Messrs. Smart, Tove

ANTHROPOLOGY

COURSES FOR UNDERGRADUATES

ANT 251 PHYSICAL ANTHROPOLOGY **3 (3-0) f**
The study of the development of man as a species; analysis of the formation and spread of races; introduction to archaelogy 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.

ANT 305 PEOPLES 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 410 THEORIES OF CULTURE **3 (3-0) f**
Prerequisites: SOC 202, SOC 301 or equivalent
The study of major anthropological theories of culture with intensive analysis of their application.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ANT 512—APPLIED ANTHROPOLOGY **3 (3-0) s**
Prerequisites: SOC 202, SOC 301 or equivalent
Special problem areas such as administration, education, health, industrialization, and urbanization are viewed from the standpoint of recent findings in cultural anthropology.

ARCHITECTURE

COURSES FOR UNDERGRADUATES

ARC 201, 202 Architectural Design I, II **4 (3-6) f s**
Prerequisite: DN 102
Required of second year students in Architecture and Landscape Architecture
Introductory exercises in architectural design. The design of small buildings of specific function and simple construction which can be related to the student's experience; emphasis on the influence of environment, climate, etc.
Messrs. Buisson, Burns, Shaw,

ARC 300 HISTORIC ARCHITECTURE RESEARCH **2 credits s**
Prerequisite: ARC 202
Required of all students in Architecture and Landscape Architecture
Research and the recording of sites, monuments, buildings, or artifacts of historical interest.
Mr. Elliott

ARC 301, 302 ARCHITECTURAL DESIGN III, IV **6 (3-12) f s**
Prerequisites: ARC 202, EM 311, PY 211
Required of third year students in Architecture
Continuing exercises in architectural design, based on larger buildings with more complex interior and exterior relationships. Emphasis on the problems of functional planning, research on building requirements, and recognized methods of construction.
Messrs. Elliott, Waugh

ARC 312 MATERIALS AND SPECIFICATIONS **3 (3-0) s**
Prerequisite: ARC 202
Required of third year students in Architecture
Functional and physical characteristics of building materials; the preparation of architectural specifications.
Mr. Waugh

ARC 401, 402 ARCHITECTURAL DESIGN V, VI **6 (3-12) f s**
Prerequisites: ARC 302, CE 339, EM 321
Required of fourth year students in Architecture
The design of large buildings or building complexes and economic and sociological influences on them, stressing the use of technology and industrialization. Emphasis on the logical coordination of the many factors of building design.
Mr. Matsumoto

ARC 421, 422 STRUCTURAL DESIGN I, II **3 (3-3) f s**
Prerequisite: CE 339
Required of fourth year students in Architecture
Principles and applications of steel and timber design; principles and application of reinforced concrete design; and elements of foundations.
Mr. Kahn

ARC 501, 502 ARCHITECTURAL DESIGN VII, VIII **7, 9 (3-12) f s**
Prerequisites: ARC 402, ARC 300
Required of fifth year students in Architecture
A continuation of ARC 401, 402 with special emphasis on the development of arch-typical designs and the use of subjective selection by the designer. An architectural thesis is required in the spring semester.
Mr. Caminos

ARC 511 PROFESSIONAL PRACTICE **2 (2-0) f**
Prerequisite: ARC 312
Required for graduation in Architecture
A study of the ethics, organization, and procedures of professional architectural practice; building codes, and legal obligations.
Mr. Waugh

ARC 531, 532 STRUCTURAL DESIGN III, IV **2 (2-2) f s**
Prerequisite: ARC 422
Required of fifth year students in Architecture
Comparative study of structures and structural elements; their possibilities and limitations; review and discussion of structural principles. Engineering consultation.

Mr. Kahn

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 AND BACTERIOLOGY

COURSES FOR UNDERGRADUATES

BO 103 GENERAL BOTANY **4 (3-2) f s**
An introduction to the major non-green and green plant groups with emphasis on the anatomy, physiology and reproduction of flowering plants.

Staff

BO 201 AQUATIC VASCULAR PLANTS **2 (1-2) f**
Prerequisite: BO 103
A comprehensive survey of marsh and aquatic vascular plants with emphasis on identification and habitat relationships. (Offered in even numbered years)

Mr. Beal

BO 211 DENDROLOGY I **2 (1-3) s**
Prerequisite: BO 103
A systematic survey of the principal hardwood (Angiosperm) genera and species of North America. Emphasis is upon field identification during the spring.

Mr. Hardin

BO 212 DENDROLOGY II **2 (1-3) f**
Prerequisite: BO 103
A systematic survey of the principal evergreen (Gymnosperm) genera and species of North America. Emphasis is upon field identification of Gymnosperms and also hardwoods using winter characteristics.

Mr. Hardin

BO 301 GENERAL MORPHOLOGY **3 (2-3) f**
Prerequisite: BO 103
A survey of the principal groups of plants from the standpoint of their structure, development and reproduction. Emphasis is placed upon evolutionary relationships as revealed by comparisons in body organization and life histories of living and extinct forms. Some time is spent on general identification of plants in their native habitats.

Mr. Ball

BO 312 GENERAL BACTERIOLOGY **4 (2-4) f s**
Prerequisites: BO 103 or ZO 103, CH 101
Open to students in Sanitary Engineering with only the chemistry prerequisite. Occurrence and activities of microorganisms in nature and disease. A study of the basic concepts and techniques of bacteriology; isolation, cultivation, observation, morphology, physiology, and nutrition of microorganisms.

Messrs. J. B. Evans, Elkan

BO 403 SYSTEMATIC BOTANY **3 (0-6) s**
Prerequisite: BO 103
A systematic survey of vascular plants emphasizing field identification, terminology, and general evolutionary relationships. Mr. Beal

BO 407 (DM 407) DAIRY BACTERIOLOGY I **4 (2-4) f**
Mr. Speck

BO 410 PLANT HISTOLOGY AND MICROTECHNIQUE **3 (1-6) f**
Prerequisites: BO 103, 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 103, CH 203 or CH 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.
Messrs. Scofield, Troyer

BO 441 PLANT ECOLOGY **3 (2-3) f**
Prerequisite: BO 103
An introduction to the study of plants in relation to their environment. Major topics considered are: factors of the environment; the structure, analysis, and dynamics of plant communities; past and present distribution of vegetation types.
Mr. Cooper

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

BO 506 (DM 506) DAIRY BACTERIOLOGY II **3 (0-6) s**
Mr. Speck

BO 512 MORPHOLOGY OF VASCULAR PLANTS **3 (2-3) f**
Prerequisite: BO 103
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 103
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 103, BO 403
A comprehensive survey of the systematics and evolution of monocot families. Special emphasis is given to terminology, morphology, identification and relationships.
(Offered in odd numbered years)
Mr. Beal

BO 523 SYSTEMATIC BOTANY OF DICOT FAMILIES **3 (2-3) f**
Prerequisites: BO 103, 403
A comprehensive survey of the systematics and evolution of dicot families. Special emphasis is given to terminology, morphology, identification, and relationships.
(Offered in even numbered years)
Mr. Hardin

BO 531 (SOI 532) SOIL MICROBIOLOGY **3 (0-6) s**
Mr. Bartholomew

BO 532 ADVANCED PLANT PHYSIOLOGY I **2 (2-0) f**
Prerequisite: BO 421 or equivalent
An advanced treatment of water, solute, and gas relations of higher green plants, with emphasis on theoretical principles.
Mr. Troyer

BO 533 ADVANCED PLANT PHYSIOLOGY II **2 (2-0) s**
Prerequisite: BO 421 or equivalent
An advanced treatment of metabolism and growth in higher green plants, with emphasis on theoretical principles.
Mr. Troyer

BO 545 ADVANCED PLANT ECOLOGY **3 (2-3) s**
Prerequisites: BO 421, BO 441 or equivalents
An advanced consideration, through class discussions and individual projects, of the principles, theories, and methods of plant ecology.
Mr. Cooper

BO 570 (CE 570) SANITARY MICROBIOLOGY **3 (2-3) s**
BO 574 PHYCOLOGY **3 (1-4) s**
Prerequisite: BO 103
A study of important and representative genera from each of the nine classes of algae, both marine and fresh water. Chief emphasis will be on structure, reproduction and taxonomic relationships, but considerable attention will also be given to algal ecology especially the community and habitat relationships of local and state flora.
Mr. Whitford

COURSES FOR GRADUATES ONLY

BO 603 (DM 603) ADVANCED DAIRY BACTERIOLOGY **4 (arranged) f s**
Mr. Speck

BO 614 (AI 614) BACTERIAL METABOLISM **2 (2-0) s**
Mr. McNeill

BO 620 ADVANCED TAXONOMY **3 (2-2) s**
Prerequisites: BO 521, BO 523 or permission of instructor.
A course in the principles of plant taxonomy including the history of taxonomy, systems of classification, rules of nomenclature, taxonomic literature, taxonomic and biosystematic methods, and monographic techniques. (Offered in even numbered years)
Mr. Hardin

BO 632 (SOI 632) ADVANCED SOIL MICROBIOLOGY **2 to 4 arranged**
Mr. Bartholomew

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. H. J. Evans

BO 640 SPECIAL PROBLEMS IN BACTERIOLOGY **Credits arranged f s**
Directed research in some specialized phase of Bacteriology other than a thesis problem but designed to provide experience and training in research.
Mr. J. B. Evans

BO 641 RESEARCH IN BACTERIOLOGY **Credits arranged f s**
Original research preparatory to writing a Master's thesis or a Ph.D. dissertation.
Graduate Staff

BO 650 SPECIAL PROBLEMS IN BOTANY **Credits arranged f s**
Directed research in some specialized phase of Botany other than a thesis problem but designed to provide experience and training in research.
Graduate Staff

BO 651 RESEARCH IN BOTANY **Credits arranged f s**
Original research preparatory to writing a Master's thesis or a Ph.D. dissertation.
Graduate Staff

BO 660 BACTERIOLOGY SEMINAR **1 (1-0) f s**
Scientific articles, progress reports in research, and special problems of interest to Bacteriologists are reviewed and discussed. Graduate student credit allowed if one paper per semester is presented at seminar.
Graduate Staff

BO 661 BOTANY SEMINAR **(1 (1-0) f s**
Scientific articles, progress reports in research, and special problems of interest to botanists are reviewed and discussed. 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, 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 calculators, 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 pyro-physical changes in ceramic bodies. Lecture and Laboratory.

MIC 413 CERAMIC PROCESS PRINCIPLES II **4 (3-3) f**
Prerequisites: MIC 312, 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 548 TECHNOLOGY OF CEMENTS **3 (3-0) s**
Prerequisite: MIC 413
The technology of the Portland cement industry including manufacture, control and uses.

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 615, 616 HIGH TEMPERATURE TECHNOLOGY **3 (2-3)**
Prerequisite: MIC 613
An advanced consideration of the generation of high temperatures, furnace designs, and atmosphere controls. Theory of sintering hot pressing and thermo-chemical properties of high-temperature materials.

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 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 sophomore in Chemical Engineering
The calculation of material and energy balances, stoichiometry, gas laws, vapor pressure, humidity, saturation, themophysics 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 to 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: 302 or ME 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 thermodyamics.

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 actions 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 THERODYNAMICS 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 investigations 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 102 GENERAL INORGANIC CHEMISTRY **4 (3-3) f s**
The language of chemistry, fundamental laws and theories, limited study of selected chemical elements, compounds and reactions. Emphasis upon atomic structure. Designed for students who plan to take advanced courses in chemistry.

Staff

CH 102L GENERAL INORGANIC CHEMISTRY LABORATORY **1 (0-3) f s**
Corequisite: CH 102
Laboratory work to supplement the laboratory of CH 102.

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 and their compounds; introductions to organic and nuclear chemistry, industrial applications of some metals, non-metals and their compounds. The laboratory work is entriely semimicro qualitative analysis.

Staff

CH 103L SEMIMICRO QUALITATIVE ANALYSIS **1 (0-2) f s**
Prerequisite: 1 year of general chemistry not including qualitative analysis
Chiefly the laboratory work of CH 103.

CH 104 GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS **4 (3-3) f s**
Prerequisite: CH 102
Homogeneous and heterogeneous equilibria and their applications to qualitative analysis; limited study of selected chemical elements, compounds, and reactions; introduction to nuclear chemistry. Emphasis upon ionic equilibria. The laboratory work is entirely semimicro qualitative analysis. Designed for students who plan to take advanced courses in chemistry.

Staff

CH 104L GENERAL CHEMISTRY QUALITATIVE ANALYSIS LABORATORY **1 (0-3) f s**
Corequisite: CH 104
Laboratory work to supplement the laboratory of CH 104.

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 211, 212 QUANTITATIVE ANALYSIS **4 (2-6) f s**
Prerequisite: CH 104
Volumetric analysis, including the techniques, chemistry, stoichiometry and basic chemical principles of neutralization, oxidation and precipitation analysis, potentiometric titrations, colorimetry, pH measurement, electrodeposition and gravimetric methods of analysis with representative laboratory applications.

Staff

CH 215 QUANTITATIVE ANALYSIS **4 (3-3) f s**
Prerequisite: CH 104
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.

Staff

CH 341, 342 PHYSICAL CHEMISTRY **3 (3-0) f s**
Prerequisites: CH 215, PY 212, MA 212
A presentation of the basic physico-chemical principles with special emphasis on states of matter, colligative properties of solutions on nonelectrolytes, surface phenomena and colloids, chemical equilibria, atomic structure, and radioactivity.

Mr. Coots

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. Long, 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

CH 430 ORGANIC PREPARATIONS **3 (1-6) s**
Prerequisite: 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 512 (TC 512) CHEMISTRY OF HIGH POLYMERS **3 (3-0)**

CH 527 ADVANCED SURVEY OF ORGANIC CHEMISTRY **3 (3-0) s**
Prerequisite: 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**
Prerequisite: 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**
Prerequisite: 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 531L, 532L 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. Sutton

CH 537 INSTRUMENTAL METHODS OF ANALYSIS **4 (2-6) s**
Prerequisite: 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 RADIOISOTOPE PRINCIPLES **3 (3-0) f**
Prerequisites: CH 215, PY 202, MA 202
A presentation of the basic knowledge of radioactivity, nuclear reactions, ionizing radiations, and radiochemistry essential to competence in the use of radioisotopes.
Mr. Coots

CH 543L RADIOISOTOPE TECHNIQUES **1 (0-3) f**
Prerequisite: CH 543 (prior to or concurrently)
A laboratory course in the physical and chemical techniques essential to competence in the use of radioisotopes.
Mr. Coots

CH 551 GENERAL BIOLOGICAL CHEMISTRY **5 (3-6) f**
Prerequisite: CH 422 or equivalent of three years of chemistry
The chemical constitution of living matter. Biochemical processes as well as compounds are studied.
Mr. Peterson

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 occuring during growth, ripening and storage of plants of plant products.
Mr. Sisler

CH 561 CHEMISTRY OF CARBOHYDRATES AND LIPIDES **3 (3-0) s**
Prerequisite: 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.
Staff

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, problems, and nucleic acids.
Staff

CH 572 CHEMISTRY OF THE VITAMINS **3 (3-0) s**
Prerequisite: CH 422 or equivalent of three years of chemistry
History, nomenclature, properties, distribution, effects of deficiencies, vitamin values.
Mr. Satterfield

CH 600 RADIOCHEMISTRY **2 (2-0) s**
Prerequisites: CH 543, CH 532
An advanced presentation of the applications of radioactivity to chemistry and of the applications of chemistry to the radio-active elements, particularly the heavy elements and fission products.
Mr. Coots

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; mechanisms of organic reactions.
Mr. Loeppert

CH 621 (AI 621) ENZYMES AND INTERMEDIARY METABOLISM **4 (3-3) f**
Prerequisite: CH 551
A study of the properties of enzymes and enzyme action, intermediary metabolism of carbohydrates, amino acids, fatty acids, vitamins, purines and prophyrins, metabolic energy relationships.
Mr. Tove

CH 622 (AI 622) PRINCIPLES OF BIOLOGICAL ASSAYS **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.
Messrs. Carter, Tove

CH 631 CHEMICAL RESEARCH **Credits by arrangement**
Prerequisite: 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.
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.
Graduate Staff

CH 651 SPECIAL TOPICS IN CHEMISTRY **Maximum 3 credits**
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, Forestry, Geological Engineering and in Landscape Architecture
Elements of plane surveying; taping, transit, level, stadia, plane table, topograpic 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 special curves; elementary astronomical 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
Corequisite EM 321
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
Corequisite EM 321
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, EM 321
Required of juniors in Architecture
Analysis of indeterminate structures; slopes and deflections; analysis of indeterminate 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.

COURSES FOR ADVANCED UNDERGRADUATES

CE 425 STRUCTURAL ANALYSIS II **3 (2-3) f**
Prerequisites: CE 324, 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**
Prerequisites: EM 321, CE 324
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**
Prerequisites: CE 427, CE 425
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 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 (3-03) 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: CE 382
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 aqueducts, 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.

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 509 PHOTOGRAMMETRY **3 (2-3) f s**
Prerequisite: CE 201
Elements of photogrammetry as applied to surveying and mapping. Aerial and terrestrial photogrammetry. Flight planning and ground controls. Stereoscopy and stereoscopic plotting instruments. Measurements on photographs.

CE 510 ADVANCED SURVEYING **3 (2-3) f s**
Prerequisite: CE 202
State coordinate systems and map projections. Elements of geodetic and astronomical surveying. Adjustment of observations by the method of least squares.

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 OPERATIONS **3 (3-0) f**
Prerequisite: CE 306
The analysis of traffic and transportation engineering operations.

CE 516 TRANSPORTATION DESIGN **3 (2-3) f**
Prerequisite: CE 306
The geometric elements of traffic and transportation engineering design.

CE 521, 522 ADVANCED STRUCTURAL DESIGN I, II **3 (2-3) f s**
Prerequisites: CE 425, CE 428 or equivalent
Complete structural designs of a variety of projects; principles of limit and prestress design.

CE 524 ANALYSIS AND DESIGN OF MASONARY STRUCTURES **3 (3-0) f**
Corequisite: 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 425
Test procedures and limitations and interpretations 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 PROCESSES 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 574 RADIOACTIVE WASTE DISPOSAL **3 (2-3) f s**
Prerequisite: PY 410
Unit operations and processes employed in treatment and disposal of radioactive wastes.

CE 580 FLOW IN OPEN CHANNELS **3 (3-0) f s**
Prerequisite: CE 481
The theory and applications of flow in open channels including dimensional analysis, momentum-energy principle, gradually varied flow, high-velocity flow, energy dissipators, spillways, waves, channel transitions and model studies.

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
The planning, administration, economics and financing of various transportation engineering facilities.

CE 602 ADVANCED TRANSPORTATION DESIGN **3 (2-3) s**
Prerequisite: CE 516
Design of major traffic and transportation engineering projects.

CE 603 AIRPORT PLANNING AND DESIGN **3 (2-3) f**
Corequisites: CE 515, 516
The analysis, planning and design of air transportation facilities.

CE 604 URBAN TRANSPORTATION PLANNING **3 (2-3) s**
Prerequisite: CE 515
Thoroughfare planning as related to land usage and urban master-planning.

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 422 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; seppage 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 credits**
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.

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. Warren

DM 402 CHEESE **3 (2-2) 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.

Staff

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 (BO 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 used in the dairy plant.
Mr. Roberts

DM 506 (BO 506) DAIRY BACTERIOLOGY II **3 (0-6) s**
Prerequisite: DM 407, (BO 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**
Prerequisites: CH 103 or CH 203, DM 401
A qualitative study of the physical, colloidal, and chemical properties of milk and its constitutents.
Mr. Aurand

COURSES FOR GRADUATES ONLY

DM 601 SEMINAR IN DAIRY MANUFACTURING **1 (1-0) f s**
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 (arranged) f s**
Prerequisite: DM 508
A quantitative study of the physical, colloidal and chemical properties of milk and its constitutents.
Mr. Aurand

DM 603 (BO 603) ADVANCED DAIRY BACTERIOLOGY **4 (arranged) f s**
Prerequisite: DM 506 (BO 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 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. Baron, Gussow, Macomber, Hertzman, Stuart

DN 111, 112 DESCRIPTIVE DRAWING I, II **2 (0-4) f s**
Required of first year students in the School of Design
Problems in visual analysis with emphasis on the systems man has devised to describe his visual experience.
Messrs. Bireline, Shaw, Cox

DN 121, 122 TECHNICAL DRAWING I, II **3 (2-4) f s**
Required of first year students in the School of Design
Descriptive Geometry and allied technical drawing. Lectures and simple exercises in analytical programming of architectural elements.
Messrs. Buisson, Matsumoto, Shaw, Shawcroft

DN 211, 212 DESCRIPTIVE DRAWING III, IV **2 (0-4) f s**
Prerequisite: DN 112
Required of second year students in the School of Design
Problems continuing the studies begun in freshman year with the addition of the study of color and its effects.
Messrs. Cox, Shawcroft

DN 311, 312 ADVANCED DESCRIPTIVE DRAWING I, II **2 (0-6) f s**
Prerequisite: DN 212
Required of third year students in the School of Design
Advanced problems in the fields of painting, sculpture, drawing, and graphics.
Messrs. Bireline, Cox, Gussow, Stuart

DN 321, 322 HISTORY OF ARCHITECTURE I, II **3 (3-0) f s**
Prerequisite: HI 245
Required of all students in Architecture and Landscape Architecture
A critical study of architecture from prehistoric times to the present including references to landscape architecture, painting, sculpture, and artifacts.
Mr. Buisson

DN 411, 412 ADVANCED DESCRIPTIVE DRAWING III, IV **2 (0-6) f s**
Prerequisite: DN 312
Required of fourth year students in the School of Design
Advanced problems in the fields of painting, sculpture, drawing, and graphics.
Messrs. Bireline, Cox, Gussow, Stuart

DN 421, 422 HISTORY OF DESIGN I, II **3 (3-0) f s**
Prerequisite: HI 246
Required of all students in Architecture and Landscape Architecture
Specialized historical studies of design fields.
Mr. Elliott

DN 511, 512 ADVANCED DESCRIPTIVE DRAWING V, VI **2 (0-6) f s**
Prerequisite: DN 412
Required of fifth year students in Landscape Architecture and Product Design
Advanced problems in the fields of painting, sculpture, drawing, and grahpics.
Messrs. Bireline, Cox, Gussow, Stuart

DN 541 SEMINAR ON IDEAS IN DESIGN **2 (2-0) f**
Corequisites: ARC 501, LA 501 or PD 501
Required of fifth year students in the School of Design
An introduction to aesthetics and the relationships of philosophic thought to design.
Mr. Kamphoefner

ECONOMICS

COURSES FOR UNDERGRADUATES

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 301 PRODUCTION AND PRICES **3 (3-0) f or s**
Prerequisite: EC 201 or EC 205
An intensive study of the functioning of the market economy. An examination of the role of prices in determining the allocation of resources, the functioning of the firm in the economy, and forces governing the production of economic goods.

EC 302 NATIONAL INCOME AND ECONOMIC WELFARE **3 (3-0) f or s**
Prerequisite: EC 201 or EC 205
An intensive examination of factors determining the national income. The economic and social effects of the level, composition, and distribution of national income will be studied with reference to theories of economic welfare and to public policy.

EC 305 BUSINESS ORGANIZATION **3 (3-0) f s**
Prerequisite: EC 201 or EC 205
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 310 ECONOMICS OF THE FIRM **3 (3-0) s**
Prerequisite: EC 201 or EC 205
An examination of the economic setting within which the business firm makes decisions, and an application of economic analysis to these decisions. Economics from the focal point of managerial decision-making.

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 342 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: EC 201 or EC 205
A course dealing with elementary legal concepts, contracts, agency negotiable instruments, sales of personal property, chattel mortgages, partnerships, 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 INTRODUCTION TO PRODUCTION COSTS **3 (3-0)**
Prerequisite: EC 312
An introduction to accounting problems peculiar to manufacturing fabrication and construction-type enterprises. Cost determination and allocation of costs for materials, labor, and overhead to the various units of product. Estimating and cost control in the production and manufacturing process. Special emphasis to be placed on analysis and interpretation of cost data.

EC 410 INDUSTRY STUDIES **3 (3-0) f**
Prerequisite: EC 201 or EC 205
An analysis of organization, market structure, and competitive behavior in specific industries, using the tools of the economist as a guide to pertinent factors and their significance. The course will be organized along the lines of intensive but broadly relevant case-studies.

EC 411 MARKETING METHODS **3 (3-0) f**
Prerequisite: EC 201 or EC 205
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 413 COMPETITION, MONOPOLY, AND PUBLIC POLICY **3 (3-0) f s**
Prerequisite: EC 201 or EC 205. EC 301 recommended but not required
An analysis of the effect of modern industrial structure on competitive behavior and performance, in the light of contemporary price theory and the theory of workable competition. A critical evaluation of the legislative content, judicial interpretation, and economic effects of the antitrust laws.

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: EC 201 or EC 205
Principles of advertising; purposes; preparation of copy; media; advertising campaigns; legislation.

EC 420 CORPORATION FINANCE **3 (3-0) f s**
Prerequisite: EC 201 or EC 205
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
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 440 ECONOMICS OF GROWTH **3 (3-0) f s**
Prerequisite: EC 201 or EC 205
An examination of the institutional background required for national economic development. The conditions apparent for past growth of nations are compared with conditions obtaining in presently retarded nations. Conclusions are drawn from this comparison to provide an introduction to the theoretical models of growth.

EC 442 EVOLUTION OF ECONOMIC IDEAS **3 (3-0) f s**
Prerequisite: EC 201 or EC 205
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: EC 201 or EC 205
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 446 ECONOMIC FORECASTING **3 (3-0) f s**
Prerequisite: EC 201 or EC 205. EC 302 recommended but not required
An examination of the basic principles and techniques of economic forecasting with strong emphasis upon the economic models upon which forecasting is based.

EC 448 INTERNATIONAL ECONOMICS **3 (3-0) f**
Prerequisite: EC 201 or EC 205
A study of international economics, including trade, investment, monetary relations, and certain aspects of economic development. Emphasis upon analytical and policy approaches, although some institutional material is included.

EC 450 ECONOMIC DECISION PROCESSES **3 (3-0) f s**
Prerequisites: EC 201 or EC 205, MA 202 or MA 212
An analysis of processes for decision making by individuals and groups. Linear programming, probability, and game theory in the light of a general theory of decision.

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.

EC 490 SENIOR SEMINAR IN ECONOMICS **3 (3-0) f s**
Prerequisite: Consent of Instructor
The terminal course in undergraduate study of economics. The student is assisted in summarizing his training, and in improving his capacity to recognize problems and to select logically consistent means of solving the problems. This is done on a small-group and individual basis.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EC 501 (AGC 501) INTERMEDIATE ECONOMIC THEORY **3 (3-0) f s**
Prerequisite: EC 301 or AGC 212 or equivalent
An intensive analysis of the determination of prices and of market behavior, including demand, costs and production, pricing under competitive conditions, and pricing under monopoly and other imperfectly competitive conditions.

EC 502 MONEY, INCOME, AND EMPLOYMENT **3 (3-0) f s**
Prerequisite: EC 302 or EC 501 or equivalent
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.

EC 503 ADVANCED ACCOUNTING **3 (3-0) f s**
Prerequisite: EC 201 or EC 205, EC 401, EC 402
Problems of asset valuation, such as depreciation, replacements, amortization, etc., as found in all types of business organizations: branch accounting, consolidations, installment selling.

EC 504, 505 PRINCIPLES OF COST ACCOUNTING **3 (2-2) f s**
Prerequisite: EC 201 or EC 205, EC 401, EC 402
Cost finding, materials costs, labor costs, overhead costs, etc., with an introduction to standard cost procedures.

EC 510 (PS 510) PUBLIC FINANCE **3 (3-0) f s**
Prerequisite: EC 201 or EC 205
A survey of the theories and practices of governmental taxing, spending, and borrowing, including intergovernmental relationships and administrative practices and problems.

EC 515 INVESTMENTS **3 (3-0) s**
Prerequisite: Junior standing
Types of investment; investment market; investment analysis; investment channels; investment fluctuations; investment policies and practices.

EC 525 MANAGEMENT POLICY AND DECISION MAKING **3 (3-0) f**
Prerequisite: 9 hours in Economics and Related Courses and consent of the instructor
A review and consideration of modern management processes used in making top-level policies and decisions. An evaluation of economic, social and institutional pressures, and of the economic and non-economic motivations, which impinge upon the individual and the organization. The problem of coordinating the objectives and the mechanics of management is examined.

EC 531 MANAGEMENT OF INDUSTRIAL RELATIONS **3 (3-0) f s**
Prerequisite: Senior standing and consent of the instructor
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 and bargaining process, and current trends and tendencies in the field of collective bargaining.

EC 550 MATHEMATICAL MODELS IN ECONOMICS **3 (3-0) f s**
Prerequisites: EC 201 or EC 205, MA 202 or MA 212. EC 450 recommended but not required
An introductory study of economic models emphasizing their formal properties. The theory of individual economic units is presented as a special case in the theory of inductive behavior. Mathematical discussions of the theory of the consumer, the theory of the firm, and welfare economics will show the relevance of such topics as constrained maxima and minima, set theory, partially and simply ordered systems, probability theory, and game theory to economics.

EC 552 ECONOMETRICS **3 (3-0) f s**
Prerequisites: EC 201 or EC 205, MA 202 or MA 212, ST 361
An analysis of methods for economic inference. Multi-equation economic models: their specification, identification, and estimation.

EC 555 LINEAR PROGRAMMING **3 (3-0) f s**
Prerequisites: EC 201 or EC 205, MA 202 or MA 212, MA 405
Recent developments in the theory of production, allocation, and organization. Optimal combination of integrated productive processes within the firm. Applications in the economics of industry and of agriculture.

EC 590, 591 SEMINAR IN SPECIAL ECONOMIC TOPICS **3 (3-0) f s**
Prerequisite: Consent of instructor
Topics presented by a visiting professor or special lecturer. This course will be offered from time to time as distinguished visiting scholars are available.

COURSES FOR GRADUATES ONLY

EC 601 ADVANCED ECONOMIC THEORY **3 (3-0) f s**
Prerequisite: EC 501 or equivalent
A rigorous examination of contemporary microeconomic theory.

EC 602 (AGC 602) MONETARY AND EMPLOYMENT THEORY **3 (3-0) f s**
Prerequisite: EC 502 or equivalent
The course consists of an analysis of the forces determining the level of income and employment; a review of some of the theories of economic fluctuations; and a critical examination of a selected macroeconomic system.

EC 603 HISTORY OF ECONOMIC THOUGHT **3 (3-0) f s**
Prerequisite: EC 442 or EC 501 or EC 502 or equivalent
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.

EC 605 RESEARCH IN ECONOMICS **Credits by arrangement**
Prerequisite: Graduate standing
Individual research in economics, under staff supervision and direction.

EC 640 THEORY OF ECONOMIC GROWTH **3 (3-0) f s**
Prerequisite: EC 440 or EC 502 or equivalent
Several theoretical models of economic growth are compared and analyzed. Contemporary developments in the theory of national economic growth are studied and evaluated for consistency with older theories.

EC 648 THEORY OF INTERNATIONAL TRADE **3 (3-0) f s**
Prerequisite: EC 448 or EC 501 or equivalent
A consideration, on a seminar basis, of the specialized body of economic theory dealing with the international movement of goods, services, capital, and payments. Also, a theoretically-oriented consideration of policy.

EC 650 ECONOMIC DECISION THEORY **3 (3-0) f s**
Prerequisites: EC 501 or equivalent, EC 550 or EC 555
Study of general theories of choice. Structure of decision problems; the role of information; formulation of objectives. Current research problems.

EC 655 TOPICS IN MATHEMATICAL ECONOMICS **3 (3-0) f s**
Prerequisite: EC 501 or equivalent, EC 550 or EC 555
A seminar and research course devoted to recent literature and developments in mathematical economics.

EC 665 ECONOMIC BEHAVIOR OF THE ORGANIZATION **3 (3-0) f s**
Prerequisites: EC 501 or equivalent, consent of instructor
This seminar will apply methods and findings derived from the behavioral sciences to the economic behavior of the organization, particularly the business firm. Among the approaches which may be utilized are organization theory, information theory, reference group theory, and decision theory.

EDUCATION

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.

Staff

ED 102 OBJECTIVES IN AGRICULTURAL EDUCATION **1 (1-0) f**
Designed to help the student understand the purpose of Agricultural Education at N. C. State College. Also provides an opportunity for students to develop an understanding of purposes of vocational agriculture in the school community.

Staff

ED 201 FARMING PROGRAMS AND FFA **2 (2-0) s**
Provides an opportunity for students to get an understanding of the place of farming programs and FFA in vocational agriculture, as well as the role of the teacher in these programs.

Staff

ED 203 INTRODUCTION TO TEACHING MATHEMATICS AND SCIENCE **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 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.

Staff

ED 313 TEACHING RURAL PEOPLE **2 (2-0) s**
The purpose of the course is to give the student an understanding of the basic principles involved in the teaching-learning process. The course will be built around problem experiences of farm people with principles of teaching and learning related to these experiences.

Staff

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. Shannon

ED 410 DRIVER EDUCATION **3 (2-2) s**
Summer session only
The principles of teaching 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.

Mr. Crawford

ED 411 STUDENT TEACHING IN AGRICULTURE **6 (3-12) f**
The first part of the semester (usually six weeks) will be on campus. The remainder of the semester will be spent in a high school department of vocational agriculture doing full-time student teaching. The student will get experience in all phases of the vocational agriculture program, including community study, adult education, home supervision. The student teacher will be supervised by the local teacher of agriculture and a member of the staff in Agricultural Education.

Staff

ED 412 TEACHING ADULTS IN AGRICULTURE **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.

Staff

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.

Staff

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 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 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

ED 470 METHODS OF TEACHING MATHEMATICS **3 (3-0) f**
A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of mathematics at the secondary level.
Mr. Speece

ED 471 STUDENT TEACHING IN MATHEMATICS **6 (2-15) f s**
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.
Mr. Speece

ED 472 DEVELOPING AND SELECTING TEACHING MATERIALS IN MATHEMATICS **2 (2-0) f s**
Developing and selecting teaching materials in keeping with the new and changing concepts of the content and emphasis in high school mathematics is essential for mathematics teachers. The course will follow the class discussion and demonstration pattern. Students will study the latest instructional materials and discover or devise materials and aids for increasing the effectiveness of the content and instruction in high school mathematics.
Mr. Speece

ED 475 METHODS OF TEACHING SCIENCE **3 (3-0) f s**
A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of physical and natural science at the secondary level.
Mr. Shannon

ED 476 STUDENT TEACHING IN SCIENCE **6 (2-15) f s**
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.
Mr. Shannon

ED 477 DEVELOPING AND SELECTING TEACHING MATERIALS IN SCIENCE **2 (2-0) f s**
Developing and selecting teaching materials in keeping with the new and changing concepts of the content and emphasis in high school science, particularly the experimental and laboratory approach to science teaching. Students will study the latest instructional materials and discover or devise materials and aids for increasing the effectiveness of the content and instruction in high school science courses.
Mr. Shannon

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

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 501 EDUCATION OF EXCEPTIONAL CHILDREN **3 (2-2) f**
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**
Prerequisite: 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 session

Prerequisite: Six hours in Education or Psychology
A study of group methods in teaching with special reference in role playing, conference techniques, and group dynamics in their application to teaching and an understanding of the student's behavior.

Staff

ED 509 WORKSHOP IN SPECIAL EDUCATION **Maximum 6 credits**
Summer session

Prerequisite: ED 501 and six hours in Psychology
The workshop in Special Education provides opportunity for group projects in all aspects of special education, and group participation in development of individual projects. Public relations, library facilities, occupational surveys, methods and materials, development of new programs, units of work and room planning are examples of projects. Project materials are collected, mimeographed, and distributed to class members to serve as a handbook for future use. Materials are frequently tried out in the practicum. Specific subject matter areas to meet formal certification requirements for special education are also taught in small groups.

Mr. Corter

ED 510 ADVANCED DRIVER EDUCATION **3 (2-2)**
Summer session

Prerequisite: ED 410
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.

Mr. Crawford

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**
The principles of selecting and organizing both technical and general related instructional material for trade extension and diversified occupations classes.

Graduate Staff

ED 524 OCCUPATIONAL INFORMATION **3 (0-3)**
Prerequisites: 6 hours of Education or Psychology, ED 420 or equivalent
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 sources 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, home-room activities, introducing occupational information informally in subject matter courses, the resource file, vocational counseling.

Mr. Morehead

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 526 SEMINAR IN INDUSTRIAL EDUCATION **Maximum 2 credits Summer session**
Prerequisite: Graduate standing or permission of the instructor
Reviews and reports on topics of special interest to graduate students in Industrial Education. The course will be offered from time to time in accordance with the availability of distinguished professors.
Mr. Hanson

ED 527 PHILOSOPHY OF INDUSTRIAL EDUCATION **2 (2-0) s**
Prerequisite: ED 422
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 530 GROUP GUIDANCE **3 (3-0)**
Prerequisites: 6 hours of education or psychology, ED 420 or equivalent
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 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 **3 (3-0) f**
Prerequisites: 6 hours from following fields—Economics, Education, Psychology or Sociology
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 interdisciplinary 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 (3-1) f**
Prerequisite: Advance graduate standing
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

ED 533 ORGANIZATION AND ADMINISTRATION OF GUIDANCE SERVICES **3 (3-0)**
Prerequisites: Graduate standing, ED 420 or equivalent
This course is designed for school guidance workers and those preparing for this field. Basic principles and current practices employed in developing, organizing, administering, and supervising guidance services in the elementary and secondary school will be studied. Interrelationship of guidance services with instruction, administrative relationships, utilization of school staff, and evaluaton of guidance services will be considered.
Mr. Morehead

ED 522 INDUSTRIAL ARTS IN THE ELEMENTARY SCHOOL **3 (Summer session)**
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 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. Scarborough, Miller

ED 558 SPECIAL PROBLEMS IN TEACHING **Maximum 6 credits**
Prerequisite: ED 411
Current problems in agricultural education. Opportunities for students to study particular problems under the guidance of the staff.

Graduate Staff

ED 563 EFFECTIVE TEACHING **3 (3-0) f s**
Prerequisite: Twelve hours in Education
Analysis of the teaching-learning process; assumptions that underlie course approaches; identifying problems of importance; problem solution for effective learning; evaluation of teaching and learning; making specific plans for effective teaching.

Messrs. Beard, Scarborough

ED 568 ADULT EDUCATION IN AGRICULTURE **3 (3-0) f s**
Prerequisite: ED 411
This course is 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 vocational agriculture. 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 vocational agriculture, as well as to methods of teaching adults.

Messrs. Beam, Scarborough

ED 590 INDIVIDUAL PROBLEMS IN GUIDANCE **3 (3-0) f s**
Prerequisites: 6 hours graduate work in Department or equivalent
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

ED 595 INDUSTRIAL ARTS WORKSHOP **3 (Summer session)**
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.

COURSES FOR GRADUATES ONLY

ED 610 ADMINISTRATION AND SUPERVISION OF VOCATIONAL EDUCATION 2 (2-0) f s
Prerequisites: PSY 304, ED 344, ED 420, ED 440 or equivalent
Administrative and supervisory problems of vocational education; practices and policies of Federal and State officers; 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, organization, administration, and the place and importance of the high school in the community in relation to contemporary social force.

Graduate Staff

ED 615 INTRODUCTION TO EDUCATIONAL RESEARCH **3 (3-0) f**
Prerequisite: Twelve hours in Education
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.

Graduate Staff

ED 616 ADVANCED PROBLEMS IN AGRICULTURAL EDUCATION **3 (3-0) f s**
Prerequisite: ED 558
Group study in current and advanced problems in the teaching and administration of agricultural education; evaluation of procedures and consideration for improving.

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 effective in a rural community. Study of leaders in the field.

Mr. Scarborough

ED 618 SEMINAR IN AGRICULTURAL EDUCATION **Maximum 2 credits**
A critical review of current problems, articles, and books of interest to students of agricultural education.

Graduate Staff

ED 619 SEMINAR IN INDUSTRIAL ARTS EDUCATION **1 (1-0) f s**
Prerequisite: Graduate standing
Presentation of current literature in the field of Industrial Arts Education; review and discussion of student papers and research problems.

Mr. Hostetler

ED 621 RESEARCH IN AGRICULTURAL EDUCATION **Maximum 6 credits**
Individual direction in research on a specific problem of concern to the student. Generally, the student is preparing his thesis or research problem.

Graduate Staff

ED 624 RESEARCH IN INDUSTRIAL ARTS EDUCATION **Maximum 6 credits f s**
Prerequisites: Eighteen credits in Education, 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 the best practice for interpreting and reporting data.

Mr. Hostetler

ED 627 RESEARCH IN INDUSTRIAL EDUCATION **Maximum 6 credits f s**
Prerequisites: Eighteen credits in Education, 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 631 EDUCATIONAL AND VOCATIONAL GUIDANCE **3 (3-0) f**
Prerequisites: 9 hours from following fields—Economics, Education, Psychology or Sociology
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 preformed 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**
Prerequisites: 9 hours from following fields—Economics, Education, Psychology or Sociology
This course is designed to aid personnel workers in secondary schools, colleges, employment offices, and social agencies to develop an understanding and to develop 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 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 improvements in service and methods of evaluating industrial arts programs.

Mr. Hostetler

ED 641 FIELD WORK IN OCCUPATIONAL INFORMATION AND GUIDANCE **2 to 6 f s**
Prerequisite: Advanced graduate standing
A practicum course in which the student undertakes field work in secondary schools, colleges, social service agencies, employment office, and industrial establishments which carry on guidance and personnel work. The student may observe and participate in some personnel service 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**
Prerequisite: Advanced graduate standing
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

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

ED 665 SUPERVISING STUDENT TEACHING **3 (3-0) f s**
Prerequisite: Twelve hours in Education
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 teachers, 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 for sophomores in EE
Fundamental laws of electric circuits, magnetic circuits, and simple circuit transients. Problem drill and laboratory exercises.

Mr. Bell, 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 steady-state alternating-current circuit theory, fundamental laws of magnetic fields and electric fields. Problem drill and laboratory exercises.

Mr. Bell, Staff

EE 301, 302 INTERMEDIATE CIRCUITS AND FIELDS **4 (2-5) f**
3 (2-2) s
Prerequisites: 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.

Messrs. Stevenson, Goetze, Staff

EE 305 ELECTRICAL MACHINERY **4 (2-5) f s**
Prerequisite: EE 202
Required of juniors in EE
A classroom and laboratory study of the principles, performance, and characteristics of direct current and alternating current machinery.

Mr. Goetze, Staff

EE 306 ELECTRICAL MACHINERY
Prerequisites: EE 301, EE 305
A continuation of EE 305 into more advanced phases of the theory of alternating- and direct-current machinery.

Mr. Goetze

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, CE, and NE
Principles, characteristics, and operation of electric equipment and systems. Theory and problems in applied electricity, motor characteristics, industrial applications, and electronics.

Staff

EE 331, 332 PRINCIPLES OF ELECTRICAL ENGINEERING **4 (3-3) f s**
Prerequisites: MA 202, PY 202
Required of seniors in EPY, IE, 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 of laboratory per week.

Staff

EE 350 ELECTRICAL APPLICATIONS IN WOOD PRODUCTS MANUFACTURING **3 (2-3)**
Prerequisites: PY 211, PY 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. Two hours recitation and one three-hour laboratory or problem per week.

Staff

COURSES FOR ADVANCED UNDERGRADUATES

EE 411 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 ELECTRONICS **4 (2-5) s**
Prerequisites: EE 301, PY 407
Required of juniors in EE
A study of the fundamentals of electrical conduction in vacuum, gases, and solids. Operating characteristics of vacuum and gaseous tubes, mercury arc rectifiers, photoelectric cells, cathode-ray tubes and solid state devices. Introduction to electronic circuit theory. One laboratory period a week illustrates the theory covered during lecture and recitation periods.

Mr. Thompson

EE 430 ESSENTIALS OF ELECTRICAL ENGINEERING **4 (3-3)**
Prerequisites: EE 301, EE 332
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. Manning

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EE 501 ADVANCED CIRCUITS AND FIELDS I **3 (2-2) f**
Prerequisites: EE 302, MA 301
Required of seniors in EE
Transient analysis of electric circuits by the Laplace transform method. The study of transient and sinusoidal steady-state response in terms of poles and zeros of network functions.

Mr. Stevenson

EE 502 ADVANCED CIRCUITS AND FIELDS II **3 (2-2) s**
Prerequisites: EE 302, HA 301
Required of seniors in EE
A study of classical electric and magnetic field theory and its application to the problems of electrical engineering. Consideration of electrostatics, magnetostatics, radiation, and guided waves, using vector methods.

Mr. Mott

EE 511 ELECTRONIC ENGINEERING **3 (3-3) f**
Prerequisites: EE 302, EE 414
Departmental elective for seniors
Comprehensive coverage of circuits and equipment using electronic devices; variable frequency effects; amplifiers, oscillators, modulators, detectors, wave-shaping circuits, generators of non-linear waveforms; basic pulse techniques; principles of electronic analogue computers. Emphasis on quantitative analysis and engineering design.

Mr. Barclay

EE 512 COMMUNICATION ENGINEERING **3 (3-3) s**
Prerequisite: EE 511
Departmental elective for seniors in EE
Application of electronic circuits and equipment to radio and wire communication systems. Elements of complete systems, wave propagation, antennas, transmitters, receivers, television, radar, electronic navigation systems, noise, special applications.

Mr. Barclay

EE 513 ELECTRIC POWER ENGINEERING **3 (3-3) f**
Prerequisites: EE 302, EE 305
Departmental elective for seniors in EE
A study of industrial power supply and power factor correction; direct and alternating current motor characteristics, starting methods, dynamic braking and speed control; motor applications, and industrial control apparatus.
Mr. Bell

EE 514 POWER SYSTEM ANALYSIS **3 (3-3) s**
Prerequisites: EE 302, EE 305
Departmental elective for seniors in EE
Analysis of problems encountered in the long-distance transmission of electric power. Line parameters by the method of geometric mean distances. Circle diagrams, symmetrical components, and fault calculations. Elementary concepts of power system stabiliyt. Applications of digital computers to power-system problems.
Mr. Stevenson

EE 515 ELEMENTS OF CONTROL **3 credit hours**
Prerequisites: EE 414, EE 305
Departmental elective for seniors in EE
Introductory theory of open and closed loop control. Functions and performance requirements of typical control systems and system components. Dynamic analysis of error detectors, amplifiers, motors, demodulators, analogue components and switching devices. Component transfer characteristics and block diagram representation.
Mr. Peterson

EE 516 FEEDBACK CONTROL SYSTEMS **3 (3-0) s**
Prerequisites: EE 501, EE 515
Departmental elective for seniors in EE
Study of feedback systems for automatic control of physical quantities such as voltage, speed and mechanical position. Theory of regulating systems and servo-mechanisms. Steady state and transient responses. Evaluation of stability. Transfer function loci and root locus plots. Analysis using differential equation and operational methods. System compensation and introduction to design.
Mr. Peterson

EE 517 CONTROL LABORATORY **1 (0-3) s**
Corequisite: EE 516
Laboratory study of feedback systems for automatic control of physical quantities such as voltage, speed and mechanical position. Characteristics of regulating systems and servo-mechanisms. The laboratory work is intended to contribute to an understanding of the theory developed in EE 516, Feedback Control Systems.
Mr. Peterson

EE 518 INSTRUMENTATION AND CONTROL IN NUCLEAR TECHNOLOGY **3 (3-3) s**
Prerequisites: EE 430 or EE 301, EE 305, EE 414, MA 301
Departmental elective for seniors in EE
Radiation detectors, pulse amplifiers, pulse shapers, amplitude discriminators, counters, coincidence circuits, reactor kinetics reactor simulators, automatic control of reactors.
Mr. Manning

EE 520 FUNDAMENTALS OF DIGITAL SYSTEMS **3 (3-0) s**
Prerequisites: EE 414 or EE 430
Departmental elective for seniors in EE
The basic theory of digital computation and control. Introduction to number systems, data handling, relay algebra, switching logic, memory circuits, the application of electronic devices to switching circuits, and the design of computer control circuits.
Mr. Bell

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 ELECTRIC NETWORK SYNTHESIS **3 (3-0) f s**
Prerequisite: EE 501
A study of modern network theory, with the emphasis on synthesis, based on the work of Brune, Bode, Quillemin Bott and Duffin, Darlington, Foster and many others. Both the realization problem and the approximation problem will be treated.
Mr. Hoadley

EE 613 ADVANCED FEEDBACK CONTROL **3 (3-0) s**
Prerequisite: EE 516
An advanced study of feedback systems for the control of physical variables. Analysis of follower systems and regulators. Mathematical and graphical description of systems. Stability theory and performance criteria. Frequency response and root locus methods of analysis. System compensation and design. Introductory analysis of non-linear systems.

Mr. Peterson

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.

Mr. Barclay

EE 616 MICROWAVE ENGINEERING **4 (3-3) s**
Prerequisite: EE 615
Analysis and design of microwave devices and systems. Theory and application of klystrons, magnetrons, traveling-wave tubes, masers, parametric amplifiers, and other modern high-frequency devices.

Mr. Barclay

EE 617 PULSE SWITCHING AND TIMING CIRCUITS **3 (3-0) s**
Prerequisites: EE 501, EE 512
Tube and transistor circuit techniques for the production, shaping, and control of nonsinusoidal wave forms. Fundamental circuits needed in pulse information systems, instrumentation, and computers.

Mr. Barclay

EE 618 RADIATION AND ANTENNAS **4 (3-3) f**
Prerequisite: EE 615
Electromagnetic wave theory applied to antennas and antenna arrays. Calculation and measurement of directional characteristics and field intensity.

Mr. Barclay

EE 621 VACUUM ELECTRON DEVICES **3 (3-0) s**
Prerequisite: EE 615
An intensive analytic study of the laws of electron emission and motion in electron tubes. Poisson's equation and conformal transformations are used to develop design criteria and formulae. Emission, space charge, beam formation and focussing, noise, tube parameters and ratings and construction techniques.

Mr. Barclay

EE 637 CIRCUIT ANALYSIS OF POWER SYSTEMS **3 (3-0) f**
Prerequisite: EE 514
An advanced treatment of symmetrical components applied to unsymmetrical systems, and simultaneous faults.

Mr. Stevenson

EE 638 POWER SYSTEM STABILITY **3 (3-0) s**
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 641 ADVANCED DIGITAL COMPUTER THEORY **3 (3-0) s**
Prerequisite: EE 520
A study of the circuits and components of modern digital computers, including basic logic systems, codes, advanced systems of circuit logic, vacuum tube, transitor, and magnetic components. Memory devices, counters, converters, adders, accumulators, imputs, outputs, and computer control systems will be analyzed.

Mr. Bell

EE 643 ADVANCED ELECTRICAL MEASUREMENTS **2 (2-0) f**
Prerequisites: EE 302, EE 414
A critical analysis of circuits used in electrical measurements, with special attention to such topics as balance convergence, effects of strays, sensitivity, the use of feedback in electronic devices, and automatic measuring systems.

Mr. Hoadley

EE 645, 646 ADVANCED ELECTROMAGNETIC THEORY **3 (3-0) f s**
Prerequisites: EE 615 or PY 503; MA 541
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. Mott

EE 650 ELECTRICAL ENGINEERING RESEARCH **Credits by arrangement**
Prerequisites: Graduate standing in EE and approval of adviser.

Graduate Staff

EE 661, 662 SPECIAL STUDIES IN ELECTRICAL ENGINEERING **3 (3-0) f s**
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, compresison, 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 PY 211, MA 201 or MA 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 EM 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 EM 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 EM 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 503 THEORY OF LINEAR ELASTICITY **3 (3-0) f s**
Prerequisites: EM 321, MA 301
The differential equation approach employed in development of the equations representing the behavior of a linear elastic solid. The elastic problem formulated in two and three dimensions and various coordinate systems. Application of the theory illustrated through selected problems.

EM 511 THEORY OF PLATES AND SHELLS **3 (3-0) f s**
Prerequisites: EM 321, MA 301
A modern study of the theory of plates and shells. Topics are selected from problems involving membranes, folded plates, circular and rectangular slabs, domes, cylindrical shells and hyperbolic paraboloids. Solutions are obtained by both classical and modern numerical methods.

EM 531 HYDRAULIC MACHINERY **2 (2-0) f s**
Prerequisite: EM 430
Theory of lift and application to properllers, 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 THEORY OF VIBRATIONS **3 or 3**
Prerequisites: EM 312 or EM 342, EM 321 or EM 343, MA 301
Free vibrations without damping; natural frequency; forced vibrations without damping; balancing of rotating and reciprocating machinery; free vibrations with damping; forced vibration with damping; vibration of systems with several degrees of freedom; shock and sound isolation; application of isolators.

EM 556 ADVANCED MECHANICS **3 (3-0) 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.

EM 601 APPLIED ANALYSIS IN STRENGTH OF MATERIALS **3 (3-0) f s**
Prerequisites: EM 551, MA 301
Advanced problems by energy methods. Difficult internal stress problems. Stresses in thin-webbed curved 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 ELASTIC STABILITY **3 (3-0) f s**
Prerequisites: EM 321, MA 301, EM 551
A study of elastic and plastic stability. The stability criterion as a determinant. The energy method and the theorem of stationary potential energy. The solution of buckling problems by finite differences and the calculus of variations. The application of successive approximations to stability problems.

EM 604 THEORY OF PLASTICITY **3 (3-0) f s**
Prerequisite: EM 503
Development of the equations representing the plastic behavior of deformable solids. Yield conditions and plastic stress-strain relations. Planestrain theory, hyperbolic equations and slip line fields. Selected problems to illustrate the theory.

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 and investigations.

EM 607 RESEARCH IN FLUID MECHANICS **3 (3-0) f s**
Special problems and investigations.

EM 608 ADVANCED FLUID MECHANICS **3 (3-0) 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.

ENG 111s ACCELERATED FRESHMAN COMPOSITION **3 (3-0) f**

ENG 112s ACCELERATED FRESHMAN COMPOSITION **6 (3-0) s**
For selected students only
An intensive program in reading and in composition for superior students. 112s will be scheduled only by students especially recommended by 111s instructors and will include work normally covered in the regular sections of ENG 112 and ENG 205.

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, ENG 215 or equivalent
A continuation of ENG 215, with intensive practice in writing and criticizing non-technical 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 424 MODERN ENGLISH USAGE **3 (3-0) s**
An intensive study of English grammar with particular emphasis on contemporary usage. A brief survey of the historical development of the language will be included.

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 ENG 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 ENG 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 masterworks drawn from English and European literature with emphasis on the great themes 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 468 MAJOR AMERICAN WRITERS **3 (3-0) f s**
Concentrated study of the writings of Emerson, Thoreau, Melville, and Whitman as they exemplify the spirit of American individualism.
(Students may not receive credit for both ENG 366 and ENG 468.)

ENG 471 THE NOVEL **3 (3-0) f s**
Analysis of representative English and American novels chosen to illustrate the structure and the development of the form.

ENG 480 MODERN DRAMA **3 (3-0) s**
A study of the development of modern drama as a form for the expression of social and humanistic ideas through a systematic examination of the plays of Ibsen, Shaw, and Eugene O'Neill.

ENG 485 SHAKESPEARE **3 (3-0) s**
A study of the principal plays with emphasis on reading Shakespeare for enjoyment.

ENG 496 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 497 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 496 or as an independent course.

ENG 498 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**
An introductory course covering the fundamentals of classification, development, habit, and control of forest insects.

Mr. Brett

ENT 312 ECONOMIC ENTOMOLOGY **3 (2-2) s**
Prerequisite: ZO 103
A basic course, covering the fundamentals of insect classification, development, food habits, and controls.

Mr. Brett

ENT 322 BEEKEEPING **3 (2-2) 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 ENT 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.
(Offered in odd numbered years)

Mr. Young

ENT 511 SYSTEMATIC ENTOMOLOGY **3 (1-4) f**
Prerequisite: ENT 301 or ENT 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.
(Offered in odd numbered years)

Mr. Young

ENT 531 INSECT ECOLOGY AND BEHAVIOR **3 (3-0) f**
Prerequisite: ENT 301 or ENT 312
The influence of environmental factors on insect development, distribution and behavior.
(Offered in odd numbered years)

Messrs. Lawson, Rabb
4 (2-4) f

ENT 541, 542 IMMATURE INSECTS **2 (2-4) s**
Prerequisite: ENT 511 or permission of instructor
541 is a study of the characteristics of the immature forms of the orders and principal families of insects. 542 is a detailed study of the immature forms of some special group of insects of the students' own choosing.
(Offered in even numbered years)

Messrs. Neunzig, Rabb

ENT 551, 552 APPLIED ENTOMOLOGY **3 (2-2) f s**
Prerequisite: ENT 301 or ENT 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.
(Offered in odd numbered years)

ENT 562 LITERATURE AND HISTORY OF ENTOMOLOGY **3 (3-0) s**
Prerequisite: ENT 301 or ENT 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 papers; toxonomic indexes and literature (with a historical background) and history of the development of zoological science from ancient to modern times with emphasis on entomology.
(Offered in even numbered years)

Mr. Farrier

ENT 572 FOREST ENTOMOLOGY **3 (2-2) s**
Prerequisites: ENT 301 or ENT 312
A study of methods of identification of forest pests, the factors governing their abundance, habits and control.
(Offered in even numbered years)

ENT 582 (ZO 592) MEDICAL AND VETERINARY ENTOMOLOGY (Parasitology II) **3 (2-3) s**
Prerequisite: ENT 301 or ENT 312
A study of the morphology, biology, and control of the parasitic orthopods of man, domestic and wild animals.
(Offered in odd numbered 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

ENT 592 ACAROLOGY **3 (2-2) f**
Prerequisite: ENT 301 or ENT 312
A systematic survey of the mites and ticks with emphasis on identification, biology, and control of the more common and economic forms attacking stored products, plants and animals, including man.
(Offered in even numbered years)

Mr. Farrier

COURSES FOR GRADUATES ONLY

ENT 602 PRINCIPLES OF TAXONOMY **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.
(Offered in even numbered years)

Mr. Young

ENT 611 INSECT PHYSIOLOGY **4 (3-2) f**
Prerequisites: ENT 312, ENT 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.
(Offered in even numbered years)

Mr. Gast

ENT 622 INSECT TOXICOLOGY **4 (3-2) s**
Prerequisites: ENT 312, CH 426 or equivalent
The course deals with chemicals 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.
(Offered in odd numbered 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 (1-0) f s**
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, and tabulator. A survey of the methods used for programming on electronic computers will be given.
Mr. Verlinden

ST 311 INTRODUCTION TO STATISTICS **3 (2-2) f s**
This course will relate general statistical concepts 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 inferences about populations from samples and the uncertainties involved in such inferences. Formulation and testing of hypotheses, elementary and basic statistical techniques.
Messrs. McVay, Monroe

ST 361 INTRODUCTION TO STATISTICS FOR ENGINEERS I **3 (3-0) 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.
Messrs. Hader, Grandage

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 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.
Messrs. Monroe, Steel

ST 512 EXPERIMENTAL STATISTICS FOR BIOLOGICAL SCIENCES II **3 (3-0) s**
Prerequisite: ST 511
Covariance, multiple regression, factorical experiments, individual degrees of freedom, incomplete block designs, experiments repeated over space and time.
Messrs. Steel, 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

ST 514 EXPERIMENTAL STATISTICS FOR SOCIAL SCIENCES II **3 (3-0) s**
Prerequisite: ST 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. Proctor

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.
Messrs. Grandage and Anderson

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.

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. Hall

ST 621 STATISTICS IN ANIMAL SCIENCE **3 (3-0) f**
Prerequisite: ST 512
Sources and magnitudes of errors in experiments with animals, experimental designs and methods of analysis adopted to specific types of animal research, relative efficiency of alternate designs, amount of data required for specified accuracy, student reports on selected topics
(Offered in 1961-62 and alternate years)
Mr. Lucas

ST 623 STATISTICS IN PLANT SCIENCE **3 (3-0) f**
Prerequisite: ST 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 or ST 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 512 or ST 514 or ST 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.
Graduate Staff

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 521, AGC 642
Decision making under uncertainty, stochastic elements in economic theories, problems of model construction, special techniques for analyzing simultaneous economic relations.

Mr. Wallace

ST 652 (AGC 652) ECONOMETRIC METHODS II **3 (3-0) f**
Prerequisites: ST 522, 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

ST 661 ADVANCED SPECIAL PROBLEMS **1-3 credits by arrangement f s**
Special lecture series on new advances in statistics.

Graduate Staff, Visiting Scholars

ST 671 ADVANCED STATISTICAL ANALYSIS **3 (3-0) f**
Prerequisites: ST 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 ST 512, 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.

Graduate Staff

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 103
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, SOI 200
Specific problems in field crop production other than forage crops. Discussion of those crops in form 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, SOI 200 recommended
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 manaement 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) s**
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. Havrey

FC 414 WEEDS AND THEIR CONTROL **3 (2-2) f**
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) s**
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 (GN 541 or HRT 541) PLANT BREEDING METHODS **3 (3-0) s**
Prerequisites: GN 512, ST 511 recommended
An advance study of methods of plant breeding as related to principles and concepts of inheritance.

Messrs. Dudley, 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 techniques and methods used in the improvement of economic plants.

Messrs. Haynes, Dudley

COURSES FOR GRADUATES ONLY

Students are to consult the instructor before registration.

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, BO 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 **1 (1-0) f s**
The profession of Forestry, its scope and opportunities; conservation of natural resources; forestry field practice.

Mr. Preston

FOR 201 WOOD STRUCTURE AND PROPERTIES **3 (1-4) f**
Required of sophomores in Forest Management.
Identification, structure, properties and uses of woods of economic importance in the United States; identification by means of hand lens is emphasized.

Mr. Thomas

FOR 202 WOOD STRUCTURE AND PROPERTIES I **2 (0-6) f**
Required of sophomores in Wood Technology and Pulp and Paper Technology.
The macro-and micro-structure of wood is emphasized in this introductory course. As related to wood structure, the physical properties and uses of several commercially important coniferous and deciduous woods are also studied. The techniques of hand lens and microscope identification of wood are covered.

Mr. Thomas

FOR 203 WOOD STRUCTURE AND PROPERTIES II **3 (2-2) s**
Prerequisite: FOR 202, PY 211
Physical properties of wood, specific gravity relationships, wood in relation to moisture, wood in relation to heat, sound, light, electricity, combustion; introduction to strength properties of wood.

Mr. Barefoot

FOR s204 SILVICULTURE **2 credits**
Sophomore Summer Camp
Growth and development of forest stands; reproduction counts, type mapping, thinning, and weeding; establishment and measurement of sample plots.

Mr. Miller

FOR s205 WOOD MACHINING PRACTICUM **1 credit**
Sophomore Summer Practicum
Prerequisite: FOR 203
Laboratory exercises in matching of wood. Staff

FOR s206 WOOD DRYING PRACTICUM **1 credit**
Sophomore Summer Practicum
Laboratory exercise in wood drying Staff

FOR s207 GLUING PRACTICUM **1 credit**
Sophomore Summer Practicum
Laboratory exercise in gluing wood and preparation of particle board. Staff

FOR s208 WOOD FINISHING PRACTICUM **1 credit**
Sophomore Summer Practicum
Laboratory exercises in wood finishing. Staff

FOR s209 PLANT INSPECTIONS **1 credit**
Sophomore Summer Practicum
Inspection of wood-using plants. Staff

FOR s210 MENSURATION PRACTICUM **2 credits**
Sophomore Summer Practicum
Laboratory exercises in mensuration. Staff

FOR s211 LOGGING AND MILLING PRACTICUM **2 credits**
Sophomore Summer Practicum
Practical exercises in logging and milling.
Staff

FOR s212 GRAPHIC METHODS **1 credit**
Sophomore Summer Practicum
Laboratory exercises in appropriate graphic methods.
Staff

FOR s214 DENDROLOGY **2 credits**
Sophomore Summer Practicum
Identification and study of trees in piedmont and mountain sections of North Carolina.
Mr. Miller

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
Suppression of forest fires, fire behavior; trips to wood industries.
Mr. Bryant

FOR s274 MENSURATION **2 credits**
Sophomore Summer Camp
Prerequisite: CE 217
Collection of field data for stand and yield tables, stem analysis, and timber surveys.
Mr. Bryant

FOR 301 WOOD PROCESSES I **4 (3-2) f**
Prerequisites: FOR 203, FOR 209
The processes of drying, gluing and finishing wood. Processes of reconstituting wood as fiberboard, hardboard and particle board. Basic requirements of various procedures and materials. Factors in selecting production methods.
Mr. Carter

FOR 302 WOOD PROCESSES II **4 (3-2) s**
Prerequisites: FOR 203, FOR 209
The theories and techniques of converting raw wood into usable products by milling, veneering and chipping round wood. Included also is the processing of finished lumber, dimension stock, plywood and other wood products.
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 and Mr. Miller

FOR 321, 322 PULP AND PAPER TECHNOLOGY **2 (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 342 FIBER ANALYSIS **2 (0-6) s**
Prerequisite: FOR 202
Fiber microscopy; the determination of fiber measurement, quality, variation and identity in pulpwood.
Mr. Barefoot

FOR 361, 362 SILVICS **3 (3-0) f**
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, ground water, and micro-climate.
Mr. Maki and Mr. Perry

FOR 372 MENSURATION **3 (2-2) s**
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. Maki

FOR 401 WOOD PRESERVATION **2 (1-3) s**
Factors causing wood deterioration; preservative matreials 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**
Manufacture of several types of papers 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**
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**
Prerequisite: FOR 361
Senior camp
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 (0-6) f**
Physical, chemical and microscopical examination of experimental and commercial papers and evaluation of the results in terms of the utility of the porducts tested.
Mr. Cook

FOR 422 FOREST PRODUCTS **3 (2-3) f**
Prerequisites: FOR 201, CH 203 or CH 426
The source and method of obtaining derived and manufactured forest products other than lumber.
Mr. Thomas

FOR 423 LOGGING AND MILLING **3 (3-0) f**
Timber harvesting and transportation methods, equipment and costs; safety and supervision; manufacturing methods with; log and lumber grades.
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 434 WOOD OPERATIONS I **3 (3-0) s**
Prerequisites: FOR 301, FOR 302, EC 450 or EC 455
Organization of manufacturing plants producing wood products including company organization, plant layout, production planning and control. Analysis of typical manufacturing operation in terms of processes, equipment, size and product specifications. The organizations and operations of Wood Products markets. Merchandising practices and procedures.
Mr. Barefoot

FOR 435 WOOD OPERATIONS II **3 (3-0) s**
Prerequisites: FOR 301, FOR 302, EC 450 or 455, MA 202 or MA 212
The application of the techniques of operations analysis to management decision making in the wood products field. Choice of products to manufacture. Allocation of production resources. Determining upon an inventory policy. Development of product distribution systems. The elements of statistical quality control.
Mr. Barefoot

FOR 441 DESIGN OF WOOD STRUCTURES **3 (2-3) s**
Prerequisites: EM 311, EM 321
Strength and related properties of commercial woods; standard A.S.T.M., strength tests; toughness; timber fastenings; design of columns; simple, laminated and box beams; trusses and arches.

Mr. Thomas

FOR 451 PAPER COLORING LABORATORY **2 (0-6) f**
Evaluation and identification of dyestuffs and the development of color formula for dyeing pulp and paper.

Mr. Libby

FOR 453 FOREST GRAZING **2 (2-0) f**
Management of range areas, all grazing regions with special consideration of the southeast.
Mr. Bryant

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 FORESTATION **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 manufactures of pulp and paper and papermaking equipment.

FOR 471 PULP TECHNOLOGY LABORATORY **4 (0-12) f**
Preparation and evaluation of the several types of wood pulp. The influences 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 CH 426
Fiber manufacturing process and equipment; wall, insulation and contaienr 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

FOR 491, 492 SENIOR PROBLEMS **1 (1-0), 4 (0-12)**
Problems selected with faculty approval in the areas of management or technology.
Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

FOR 501 FOREST VALUATION **3 (2-3) f**
Prerequisites: 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**
Prerequisites: FOR 361, BO 421
The principle 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 forest; supply of, and demands 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**
Prerequisite: FOR 202
Structure, identification, properties, characteristics and use of tropical woods, especially those used in plywood and furniture.

Mr. Barefoot

FOR 521, 522 CHEMISTRY OF WOOD AND PRODUCTS **3 (2-3) f s**
Prerequisites: FOR 201 or FOR 202, CH 215, CH 426, PY 212
Fundamental chemistry and physics of wood and wood components; pulping principles; electrical and thermal properties.

Mr. Stamm

FOR 531, 532 FOREST MANAGEMENT **3 (2-3)**
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. Bryant

FOR 533 ADVANCED WOOD STRUCTURES AND IDENTIFICATION **2 (0-6) f**
Prerequisite: FOR 202
Advanced microscopic identification of the commercial woods of the United States and some tropical woods; microscopic anatomical features and laboratory techniques.

FOR 553 FOREST PHOTOGRAMMETRY **2 (2-6) s**
Prerequisite: FOR 372; Corequisite: FOR 531
Interpretation of aerial photographs, determination of density of timber stands and area mapping.

Mr. Bryant

FOR 573 METHODS OF RESEARCH IN FORESTRY **Credits arranged**
Prerequisites: Senior or Graduate standing
Research procedures, problem outlines, presentation of results; consideration of selected studies by forest research organizations; sample plot technique.

Mr. Maki, Mr. Zobel

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: Graduate standing
Directed studies in forest management.

Graduate Staff

FOR 603 TECHNOLOGY OF WOOD ADHESIVES **3 (2-3) s**
Prerequisites: CH 425, CH 426; FOR 433
The fundamentals of adhesives as applied to wood-to-wood and wood-to-metal bonding. Technology of adhesives. Preparation and use of organic adhesives. Testing of adhesives and evaluation of quality of adhesives and bonded joints.

FOR 604 TIMBER PHYSICS **3 (3-0) f**
Prerequisites: FOR 441
Density, specific gravity and moisture content variation affecting physical properties; physics of drying at high and low temperatures; thermal, sound, light and electrical properties of wood.

FOR 605 DESIGN AND CONTROL OF FOOD PROCESSES **3 (3-0) s**
Prerequisites: FOR 604
Design and operational control of equipment for processing wood.

FOR 606 WOOD PROCESS ANALYSIS **3 (2-2) f**
Prerequisites: FOR 512, FOR 604
Analysis of wood processes through the solution of comprehensive problems involving the physics of temperature and moisture relations.

FOR 607 ADVANCED QUALITY CONTROL **3 (3-0) s**
Prerequisites: FOR 606, ST 515
Advanced statistical quality control as applied to wood processing.

FOR 611 FOREST GENETICS **3 (3-0) f 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 desirbale qualities and on fundamentals of controlled breeding.

Mr. Zobel

FOR 621 ADVANCED WOOD TECHNOLOGY PROBLEMS **Credits arranged**
Prerequisite: Graduate standing
Selected problems 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 (1-0) f s**
Prerequisite: Graduate standing in Forestry or closely allied fields
Presentation and discussion of progress reports on research, special problems and outstanding publications in forestry and related fields.

Graduate Staff

GENETICS

COURSES FOR UNDERGRADUATES

GN 301 GENETICS IN HUMAN AFFAIRS **3 (3-0) f s**
Fundamental principles of genetics will be presented at a level not requiring prerequisite courses in biological sciences but sufficient for an understanding of the relation of genetics to society and technology. A survey will be given of current knowledge of inheritance of human traits.

Mr. Bostian

COURSES FOR ADVANCED UNDERGRADUATES

GN 411 THE PRINCIPLES OF GENETICS **3 (2-2) f**
Prerequisites: BO 103, ZO 103
An introductory course. The physical basis of inheritance; genes as units of heredity and development; qualitative and quantitative aspects of genetic variation.

Mr. Bostian

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

GN 503 (AI 503) GENETIC IMPROVEMENT OF LIVESTOCK **3 (2-3) f s**

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 512 or with consent of instructor
The chromosomes as vehicles of heredity. Mitosis and meiosis as bases of genetic stability and recombination. Structural and numerical aberrations and their effect upon the breeding systems of plants and animals. Interspecific hybrids and polyploids. Lectures and laboratory.

Mr. Gerstel

GN 520 (PO 520) POULTRY BREEDING **3 (3-0) f**

GN 532 (ZO 532) BIOLOGICAL EFFECTS OF RADIATION **3 (3-0) s**
(Offered in 1961-62 and alternate years.)

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) s**
Prerequisites: GN 512, and either ST 511 or consent of instructor
Principles and methods of plant breeding.

Messrs. Dudley, Haynes

GN 542 (FC 542 or HRT 542) PLANT BREEDING FIELD PROCEDURES **2 (0-4)**
Summer session

COURSES FOR GRADUATES ONLY

GN 601 (PO 601) ADVANCED POULTRY BREEDING **3 (3-0) f s**

GN 602 (AI 602) POPULATION GENETICS IN ANIMAL IMPROVEMENT **3 (3-0) f**

GN 607 (PP 607) GENETICS OF FUNGI **3 (3-0) f**
Prerequisites: GN 513 or graduate standing in Botany and Zoology
Review of major contributions in fungus genetics with emphasis on principles and theories that have evolved in recent developments.
(Offered in 1960-61 and alternate years.)

Mr. Nelson

GN 611 (FOR 611) FOREST GENETICS **3 (3-0) f s**

GN 614 CYTOGENETICS II **3 (0-6) s**
Prerequisite: GN 512 or either GN 513 or GN 540
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.
(Offered in 1961-62 and alternate years.)

Mr. Smith

GN 620 GENETIC CONCEPTS OF SPECIATION **3 (3-0) s**
Prerequisites: GN 512 and either GN 513 or GN 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.
(Offered in 1961-62 and alternate years.)

Mr. Mettler

GN 626 (ST 626) STATISTICAL CONCEPTS IN GENETICS **3 (3-0) s**

GN 631 MATHEMATICAL GENETICS **3 (3-0) f**
Prerequisites: GN 512, GN 513; Recommended: ST 511 and ST 521
Mathematical representations of basic genetic principles such as gene segregations, linkage relations and genetic maps of chromosomes. Symbolic logics of genetics. Applications of various frequency distribution theories to genetic and biological phenomena. Analyses of experimental and natural populations: estimation of gene frequencies, recombination fractions, population numbers, and selective values. Evolutionary dynamics of genetic populations.
(Offered in 1961-62 and alternate years.)

Mr. Kojima

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 **2 (2-0) f s**
Prerequisites: Graduate standing, consent of instructor
Informed group discussion of prepared topics assigned by instructor.

Graduate Staff

GN 651 SEMINAR **1 (1-0) f s**
Prerequisite: Graduate standing

GN 661 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.
Graduate Staff

GN 671 SPECIAL PROBLEMS IN GENETICS **1 to 3 f s**
Prerequisites: Advanced graduate standing and consent of instructor
Special topics designed for additional experience and research training.
Graduate Staff

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

MIG 222 HISTORICAL GEOLOGY **3 (2-3) f**
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 s**
Prerequisite: CH 103
Crystallography, and physical and chemical mineralogy. Lectures and laboratory work.
Messrs. Miller, Brown

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. Miller

MIG 372 ELEMENTS OF MINING ENGINEERING **4 (2-6) s**
Prerequisite: MIG 120, 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, MIG 330
Mode of occurrence, association, origin, distribution and uses of economically valuable minerals. Lectures, laboratories and field trips.
Mr. Brown

MIG 442 PETROLOGY **3 (2-3) s**
Prerequisites: MIG 120, MIG 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, MIG 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) f s**
Reports and discussion of current professional topics.

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 330, PY 202
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, 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.

Mr. Brown

COURSES FOR GRADUATES ONLY

MIG 611, 612 ADVANCED ECONOMIC GEOLOGY **3 (3-0) f s**
Prerequisites: MIG 411, MIG 412
Detailed study of the origin and occurrence of specific mineral deposits. Regional correlations.

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. Brown

MIG 642 ADVANCED PETROGRAPHY **3 (1-4) s**
Prerequisites: MIG 442, MIG 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. Thesis problems.

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 political, economic, social, intellectual, and international movements in Europe from the end of the Middle Ages to the present, with an introduction covering the medieval period. The course divides at 1789. The semesters may be taken separately.

HI 245, 246 HISTORY OF EUROPEAN CIVILIZATION **3 (3-0) f s**
A history of European civilization from the Golden Age of Greece to the present. Those social, political, and economic currents most influential in the formation of modern society are interwoven through the principal periods of cultural expression.

HI 251 THE UNITED STATES THROUGH RECONSTRUCTION **3 (3-0) f**
A study of major historical developments in the growth of the American nation through the political phases of the Reconstruction period following the Civil War.

HI 252 THE UNITED STATES SINCE RECONSTRUCTION **3 (3-0) f s**
A study of major historical developments in the growth of the American nation beginning with economic and social phases of the Reconstruction period following 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 351 BRITISH HISTORY **3 (3-0) f s**
A study of the political, social, economic, and cultural past of the British Isles from Roman times to the present. Emphasis is placed on the position of Britain in Europe, her colonial expansion, and on the connection between British and early American history.

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 the 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 Amercian 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 GOVERMENTAL 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**
A survey of the organization and functions of the diverse rural and urban governments in the United States, emphasizing current problems and attempts to solve them.

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.

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 STATE GOVERNMENT **3 (3-0) s**
Prerequisite: PS 201 or an acceptable substitute.
Selected problems arising from the operation of legislative, administrative, and judicial machinery. 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. Special attention will be given to North Carolina.

PS 461 (SAME AS EC, HI 461) THE SOVIET UNION **3 (3-0)**

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 s**
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 510 (SAME AS EC 510) PUBLIC FINANCE **3 (3-0) f s**
Prerequisite: EC 201 or EC 205
A survey of the theories and practices of governmental taxing, spending, and borrowing, including intergovernmental relationships and administrative practices and problems.

Mr. Block

PS 512 AMERICAN CONSTITUTIONAL THEORY **3 (3-0) f 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

PS 610 APPLIED PRINCIPLES OF PUBLIC ADMINISTRATION **2-4 by arrangement f**
Prerequisite: PS 502 or an acceptable substitute.
An advanced course in administrative principles and methods. Students will perform individual or group research, under supervision, in specific administrative topics within the context of those public agencies which function in their respective fields of technology.

Mr. Block

PS 620 PROBLEMS IN POLITICAL SCIENCE **2-4 by arrangement f**
Prerequisite: Advanced graduate standing.
An independent advanced research course in selected problems of government and politics. The problems will be chosen in accordance with the needs and desires of the students registered for the course.

Graduate Staff

HORTICULTURE

COURSES FOR UNDERGRADUATES

HRT 201 PRINCIPLES OF HORTICULTURE **3 (3-0) f s**
Attention will be directed to the basic principles involved in and the application of these principles to the production, processing and utilization of fruit, vegetable, and ornamental crops. Attention will also be given to the economic importance and distribution of horticultural enterprises.

Mr. Gardner

HRT 211, 212 ORNAMENTAL PLANTS **3 (1-5) f s**
Prerequisite: BO 103
Distribution, botanical characters and relationships, adaptation and usage of ornamental trees, shrubs, vines, and herbaceous plants.

Mr. Randall

HRT 301 PLANT PROPAGATION **3 (2-2) s**
Prerequisite: BO 103
A study of principles, methods, and practices in seedage, cuttage, division, budding, grafting, and other methods of propagation. Consideration will also be given to scion and stock relationships and dormancy.

Mr. Randall

HRT 321 GRADING, PACKING, AND INSPECTION OF FRUITS AND VEGETABLES 3 (2-3) f
Prerequisite: BO 103
A study of grades and standards for the principal fruit and vegetable crops. Practice in grading, packing, variety, and disease identification designed to develop an understanding of quality. Field trips will be taken to produce markets and warehouses.

Mr. Gardner

HRT 342 LANDSCAPE GARDENING **3 (2-3) f**
The application of the principles of design to the landscaping of small properties and the selecting and planting of trees, shrubs, flowers, and lawn grasses. Students will be required to work out detailed landscape plans. Visitations will be made to outstanding homes and gardens.

Mr. Cannon

HRT 351 GREENHOUSE MANAGEMENT **3 (2-2) f**
Prerequisite: BO 103, SOI 200
Physiological influence of greenhouse environment on growth and production. A study of various types of structures, heating, watering, ventilating, sterilization, and business management practices.

Mr. Randall

HRT 411 NURSERY MANAGEMENT **3 (2-3) f**
Prerequisites: BO 103, SOI 200
The principles and practices involved in the production, management, and marketing of field-grown and container-grown nursery plants. Field trips will be taken.

Mr. Cannon

HRT 421 FRUIT PRODUCTION **3 (2-3) f**
Prerequisites: BO 103, SOI 200
A study of identification, adaptation, and methods of production and marketing of the principal tree and small fruits. Modern practices as related to selection of sites, nutritional requirements, management practices, and marketing procedures will be discussed.

Mr. Correll

HRT 432 VEGETABLE PRODUCTION **3 (2-3) s**
Prerequisites: BO 103, SOI 200
A study of the origin, importance, distribution, botanical relationships, and principles of production and marketing of the major vegetable crops.

Mr. Miller

HRT 441 FLORICULTURE I **3 (2-3) f**
Prerequisites: BO 103, SOI 200
The scope and importance of the commercial flower industry; the basic principles and practices involved in the production and marketing of flowers grown in the greenhouse and in the field.

Mr. Randall

HRT 442 FLORICULTURE II **3 (2-3) s**
Prerequisites: BO 103, SOI 200
Principles and methods of production of commercial flower crops in the greenhouse and in the field, including fertilization, moisture, temperature, and light relationships, insect and disease control, and marketing of cut flowers and pot plants.

Mr. Randall

HRT 451 PRINCIPLES OF FRUIT AND VEGETABLE PROCESSING **3 (2-2) f**
Prerequisite: BO 103
Principles and methods involved in the preservation of fruits and vegetables with emphasis on the major commercial processes.

Mr. Jones

HRT 462 GRADING PROCESSED FRUITS AND VEGETABLES **2 (1-2) s**
Prerequisite: Permission of Instructor
Methods of inspection, grading and critical evaluation for quality of the principal fruit and vegetable products.

Mr. Hoover

HRT 471 ARBORICULTURE **3 (2-3) s**
Prerequisites: BO 103, SOI 200
A study of the principles and practices in the care and maintenance of ornamental trees and shrubs, such as pruning, fertilization, control of insects and diseases, and tree surgery. Field trips will be taken.

Mr. Cannon

HRT 481 BREEDING OF HORTICULTURAL PLANTS **3 (2-2) f**
Prerequisite: GN 411
The application of genetic and other biological sciences to the improvement of horticultural crops.

Messrs. Galletta, Henderson

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

HRT 501 RESEARCH PRINCIPLES **Credits by Arrangement**
Prerequisite: Permission of Instructor
Investigation of a problem in horticulture under the direction of the instructor. The students obtain practice in experimental techniques and procedures, critical review of literature, and scientific writing. The problem may last one or two semesters. Credits will be determined by the nature of the problem, not to exceed a total of 4 hours.

Graduate Staff

HRT 521, 522 TECHNOLOGY OF FRUIT AND VEGETABLE PRODUCTS **3 (2-2) f s**
Prerequisite: BO 312
Comprehensive treatment of principles and methods of preservation of fruits and vegetables, including studies of commercial plant operations, and visits to food processing plants.

Mr. Jones

HRT 541 (GN 541 or FC 541) PLANT BREEDING METHODS **3 (3-0) s**
Prerequisites: GN 512; Recommended: ST 511
An advanced study of methods of plant breeding as related to principles and concepts of inheritance.

Messrs. Dudley, Haynes

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. Dudley, Haynes

HRT 552 GROWTH OF HORTICULTURAL PLANTS **3 (2-3) s**
Prerequisite: BO 421
A study of the effect of nutrient-elements, water, light, temperature, and growth substances on horticultural plants.

Mr. Schramm

HRT 562 POST-HARVEST PHYSIOLOGY **3 (3-0) s**
Prerequisite: BO 421
A study of chemical and physiological changes that occur during handling, transportation, and storage which affect the quality of horticultural crops. Consideration will be given to pre and post-harvest conditions which influence these changes.

Messrs. McCombs, Ballinger

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 621 METHODS AND EVALUATION OF HORTICULTURAL RESEARCH **3 (3-0) f**
Prerequisite: Graduate Standing
Principles and methods of research in the field of horticulture and their application to the solution of current problems. Critical study and evaluation of scientific publications. Compilation, organization, and presentation of data.

Mr. Cochran

HRT 641 RESEARCH
Prerequisite: Graduate standing in Horticulture, consent of Chairman
Original research on specific problems in fruit, vegetable, and ornamental crops, or in food processing. Thesis prepared should be worthy of publication. A maximum of 6 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 and special lectures. Students will be required to present one or more papers. Attendance of all graduate students is required.

Graduate Staff

INDUSTRIAL ARTS

COURSES FOR UNDERGRADUATES

IA 100 INTRODUCTION TO INDUSTRIAL ARTS **1 (1-0) f**
A basic course designed to orient the student to college life and to introduce him to the philosophy, objectives, and scope of industrial arts as related to teacher education and industrial employment. A study of the problems and opportunities in the profession.

Staff

IA 103 DRAFTING I **3 (1-4) f**
Graphical communication encompassing sketching and instrument drawing. Theory and practice taught through the medium of freehand sketching involving oblique, isometric, perspective, exploded, assembly, sections, and orthographic projection type drawings. The last portion of the course is devoted to instrument drawing.
Mr. Troxler

IA 104 DRAFTING II **3 (1-4) s**
Prerequisite: IA 103
A study of house planning and construction. Investigation of the factors to be considered by the consumer in building or buying a house including location, building codes, FHA requirements, heating and ventilation, construction details, materials of construction. Laboratory work includes the design and drawing of a set of house plans.
Mr. Troxler

IA 107 WOODS I **3 (1-4) f**
This course is an introduction to the basic problems of production with hand tools and machines. Group and individual problem solving in product design, selection of materials, organization of personnel, and laboratory facilities enable students to participate in a variety of experiences.
Mr. Briley

IA 108 WOODS II **3 (1-4) s**
Prerequisite: IA 107
This is an advanced course which seeks to develop the students' knowledge and creative ability in solving problems using wood and related materials as the media. An opportunity will be provided to solve tooling problems as well as increase the individual's proficiency with hand and power tools.
Mr. Briley

IA 203 TECHNICAL SKETCHING **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 drawing, 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 104, IA 107, IA 206
A study of design as related to industry and the industrial arts laboratory. Creative design and individual expression through problems involving the utilization of industrial materials.
Mr. Troxler

IA 206 METAL PROCESSING I **3 (1-4) f**
Fundamentals of metalwork. Hand and machine tool applications. Emphasis on layout, orientation to the lathe, milling machine, shaper, surface grinder, and cut-off operations. Experiences in bench metal and welding. Study of mass production problems through group experience.
Mr. Moeller

IA 207 METAL PROCESSING II **3 (1-4) s**
Prerequisite: IA 206
Fundamentals of foundry and sheet metal in conjunction with experiences of some precision using engine lathe, shaper, milling machine, and surface grinder. Analysis of metal problems in terms of principle applications and machine scheduling.
Mr. Moeller

IA 215 SHEET METAL **1 (0-2) f**
A course designed to provide practical experience in the use of tools, materials and processes involved in basic sheet metal fabrication.
Mr. Moeller

IA 304 GENERAL SHOP ORGANIZATION **2 (1-2) s**
Prerequisites: IA 104, IA 108, IA 207, IA 307
Application of principles of industrial processes to general shop organization and operation. Analysis of products. Methods, techniques of production of laboratory projects including a variety of materials suitable to varying educational levels.
Mr. Troxler

IA 306 GRAPHIC ARTS **3 (1-4) s**
This course is an introduction to the basic printing areas of letterpress, offset, photoprinting, silkscreen, and bookbinding. Students will be given the opportunity to develop materials for course outlines which may be used when teaching in hte secondary schools.
Mr. Briley

IA 307 BASIC ELECTRICITY **3 (1-4) f**
Prerequisites: PY 211, PY 212
The fundamentals of electricity as applied to resistive, inductive, capacitive and magnetic circuits. Emphasis are upon applications of electrical principles to light and power circuits, automobile circuits, motors, and controls.
Mr. Young

IA 308 BASIC ELECTRONICS **3 (1-4) s**
Prerequisite: IA 307
The fundamentals of electronics as applied to power supply, amplifier and oscillator circuits. Applications of electronic principles as found in the super-hetrodyne radio are studied.
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 321 METALWORK TECHNOLOGY **2 (1-2) f s**
Prerequisites: IA 206, IA 207 or equivalent
Applications of principles of industrial techniques and processes to the development and construction of products and equipment utilizing a variety of industrial materials. Emphasis will be given to research, problem investigation related to design, function and production procedures.
Mr. Moeller

IA 465 INDEPENDENT STUDY IN INDUSTRIAL ARTS **6 f**
A course designed to develop problem-solving ability through research activities in industrial arts. Problems in industrial arts curriculum, method and content are carefully selected, designs or plans of action are prepared, and final papers are presented and defended before a faculty committee.
Staff

IA 480 MODERN INDUSTRIES **3 (3-0) f s**
Prerequisite: Senior standing
An overview of the function and organization of modern industry. Principles of work simplification, motion economy, processing, and scheduling are reviewed. The effects of technological change on labor, management, and consumer are considered. Attention will be focused on contributions of technology to specific industrial processes in machining, forming, fabricating in relationship to principles, types of equipment and usage areas.
Mr. 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

IA 570 LABORATORY PROBLEMS IN INDUSTRIAL ARTS **A maximum of 6 credits**
Prerequisites: Senior standing, 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.
Staff

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

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 (2-3) 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 (3-0) 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.

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. Capital 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 Corequisite: 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

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)**
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; Corequisites: IE 332 or IE 202, FOR 203
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) f**
Study of basic factors bearing on selection of ideal location, equipment, and organization to serve a specific market with 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, IE 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 productions. 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. The course covers the use of new engineering materials and their effect on furniture construction.

IE 350 MECHANISMS AND MACHINE DESIGN **3 (2-3) s**
Prerequisites: IE 217, IE 218; Corequisite: EM 343
Fundamental principles of stress, strain, deflection of beams, combined stresses and strains, shafts, spring, gears, linkages, and cams, with emphasis on applications to jig and fixtures design and special tooling.

IE 401 INDUSTRIAL ENGINEERING ANALYSIS **3 (3-0) f**
Prerequisite: IE 304, MA 301, 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 404 INTRODUCTION TO TOOL ENGINEERING **3 (2-3) s**
Prerequisites: IE 217, IE 218, EM 343
The development of effective production process design through a study of theory and characteristics of material removal and forming processes; with emphasis on quality requirements of the product, operations study, and the economics of tooling.

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) f**
Prerequisites: IE 401, IE 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) f**
Prerequisites: IE 401, IE 443
Principles and methods for automatic processing. The design of product, process, and controls. Economic, physical, and sociological effects of automation.

IE 521 CONTROL SYSTEMS AND DATA PROCESSING **3 (3-0) f**
Prerequisites: IE 401
This course is designed to train the student in the problem 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. Case problems will be used extensively.

IE 531 QUANTITATIVE JOB EVALUATION METHODS **3 (3-0)**
Prerequisite: IE 401
A study of statistical and mathematical methods of testing and designing job evaluation plans. Ranking, contingency, and analysis of variance methods of testing plans and rating performance. Multiple regression and linear programming methods of designing plans.

IE 543 STANDARD DATA **3 (3-0) f**
Prerequisites: 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 data; methods of calculating standards from data; application of standard data in cost control, production planning and scheduling, and wage incentives.

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 use of standard costs as a management tool; use of industrial engineering techniques in establishing standard costs for labor, material, and overhead. Analysis of variances and setting of budgets. Measures of management performance.

IE 581 PROJECT WORK **2 to 6 f s**
Investigation and report on an assigned problem for students enrolled in the fifth-year curriculum in Industrial Engineering.

COURSES FOR GRADUATES ONLY

IE 621 INVENTORY CONTROL METHODS **1 (1-0) f s**
Prerequisites: IE 402, IE 521, MA 511
A study of inventory policy with respect to reorder sizes, minimum points, and production schedules. Simple inventory models with restrictions, price breaks, price changes, analysis of slow-moving inventories. Introduction to the smoothing problem in continuous manufacturing. Applications of linear and dynamic programming and zero-sum game theory.

IE 651 SPECIAL STUDIES INDUSTRIAL ENGINEERING **Credits by arrangement**
Prerequisite: Graduate standing
The purpose of this course is to allow individual students 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 has 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 SEMINAR **1-1**
Seminar discussion of industrial engineering problems for graduate students. Case analyses and reports.

IE 691 INDUSTRIAL ENGINEERING RESEARCH **Credits by arrangement**
Graduate research in Industrial Engineering for thesis credit.

LANDSCAPE ARCHITECTURE

COURSES FOR UNDERGRADUATES

LA 301, 302 LANDSCAPE DESIGN I, II **5 (3-9) f s**
Prerequisite: ARC 202
Required of third year students in Landscape Architecture
The landscape survey, investigation, and analysis. Use of first and second year design principles in specific landscape architecture problems. Covers the small scale design section in the complete third, fourth, and fifth year landscape cycle.

Mr. Thurlow

LA 311, 312 LANDSCAPE CONSTRUCTION I, II **4 (2-6) f s**
Required of third year students in Landscape Architecture
The physical elements of landscape design, particularly earthwork, grading, quantities, construction, horizontal and vertical alignment of roads, and principles of statics. Lecture and laboratory work dealing with landscape structural analysis and materials, surface drainage and run-off, under-drainage; external lighting, water supply, waste, sanitation treatment, and fire protection.

Mr. Clarke

LA 401, 402 LANDSCAPE DESIGN III, IV **6 (3-9) f s**
Prerequisite: LA 302
Required of students in Landscape Architecture.
Regional survey investigation and analysis. Site planning and environmental dseign. Covers the medium scale design section in the complete third, fourth, and fifth year design cycle. (Correlation with LA Construction and LA Planting Design courses.)

Mr. Thurlow

LA 421, 422 PLANTING DESIGN **4 (2-6) f s**
Prerequisites: HRT 202, LA 302, LA 312
Required of students in Landscape Architecture
The appraisal of plants as objects of design and their orderly arrangement for landscape effect. Techniques for recording design, specifications, and cost estimates. (Correlation with Landscape Design and Landscape Construction courses.)

Mr. Thurlow

LA 501, 502 LANDSCAPE DESIGN V, VI **6,8 (4-8) f s**
Prerequisite: LA 402
Required of 5th year students in Landscape Architecture
Large scale landscape design and ecological planning, analysis, and investigation. At least one research or thesis project.

Mr. Thurlow

LA 511 LANDSCAPE CONSTRUCTION III **4 (2-6) f**
Prerequisite: LA 312
Required of fifth year students in Landscape Architecture
Landscape structures, materials, and construction continued from LA 312. Office practice, procedure, ethics, and law; contracts, specifications, and bidding.

Mr. Clarke

MATHEMATICS

COURSES FOR UNDERGRADUATES

MA 101 ALGEBRA AND TRIGONOMETRY **5 (4-2) f s**
Topics include: systems of equations involving quadratics, inequalities, variation, binomial theorem, progressions; logarithms, linear equations and determinants, theory of equations; trigonometric functions of general angle, identities and multiple angle relations, radian measure, inverse trigonometric functions, solution of triangles with emphasis on laws of sines and cosines.

MA 102 ANALYTIC GEOMETRY AND CALCULUS I **4 (3-2) f s**
Prerequisite: MA 101
Required of freshman in the Schools of Engineering and Physical Sciences and Applied Mathematics. The first of three semesters of a unifed course in analytic geometry and calculus. Topics studied include rectangular coordinates in the plane with graphs and equations of lines, algebraic curves, including the conic sections and others examined by general discussion methods. Also introduced are functions, limits, continuity, differentiation of algebraic functions, with applications of derivatives and differentials.

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**
Prerequisite: MA 111 or MA 101
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 101 or 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 insurance, elementary statistics.

MA 201 ANALTIC GEOMETRY AND CALCULUS II **4 (3-2) f s**
Prerequisite: MA 102 (with a minimum grade of C)
Required of sophomores in the Schools of Engineering and Physical Sciences and Applied Mathematics. The second of three semesters of a unifed course in analytic geometry and calculus. Topics studied include indefinite and definite integrals of algebraic functions and their applications; differentiation of transcendental functions; polar coordinates, parametric equations, curvilinear motion and curvature; formal integration; integration by parts, substitution, and partial fractions.

MA 202 ANALYTIC GEOMETRY AND CALCULUS III **4 (3-2) f s**
Prerequisite: MA 201
Required of sophomores in the Schools of Engineering and Physical Sciences and Applied Mathematics. The third of three semesters of unified course in anlaytic geometry and calculus. Topics studied include areas, volumes, lengths of curves, centroids, moments of inertia in rectangular and polar coordinates; approximate integration, improper integrals, indeterminate forms; infinite series and expansion of functions; solid analytic geometry and partial differentiation, multiple integrals in rectangular, cylindrical and spherical coordinates.

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.

MA 215 INTRODUCTION TO FINITE MATHEMATICS **3 (3-0) f s**
Prerequisite: MA 211 or equivalent
This course includes the following related topics: Elementary symbolic logic and truth tables, introduction to sets and subsets, other number systems, the partitioning of sets, introduction to probability theory and finite Stochastic processes, elementary linear programming and game theory.

MA 301 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, undetermined coefficients, operators. Systems of equations; scaling variables, applications to networks and dynamical systems. Introduction to series-solutions; solutions by use of analog computer.

MA 302 THEORY OF EQUATIONS **3 (3-0) f**
Prerequisite: MA 202
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.

MA 303 DIFFERENTIAL EQUATIONS AND INFINITE SERIES **4 (4-0) s**
Prerequisite: MA 202 (Superior Student Program)
Infinite series and Taylor expansions. 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; demensional analysis. (Students are to take either MA 301 or 303, but not both.)

COURSES FOR ADVANCED UNDERGRADUATE

MA 403 FUNDAMENTAL CONCEPTS OF ALGEBRA **3 (3-0) f**
Prerequisites: MA 202 or MA 212
Integers; integral domains; rational numbers; fields, rings, groups. Boolean algebra.

MA 404 FUNDAMENTAL CONCEPTS OF GEOMETRY **3 (3-0) s**
Prerequisite: MA 202 or MA 212
Foundations of geometry; laws of logic; affine geometry; geometric transformations; homogeneous coordinates; comparison of Euclidean and non-Euclidean geometrics.

MA 405 INTRODUCTION TO DETERMINANTS AND MATRICES **3 (3-0) f s**
Prerequisite: MA 202 or MA 212
Properties of determinants, theorems of Laplace and Jacobi; systems of linear equations. Elementary operations with matrices; inverse, rank, characteristic roots and eigenvectors. Introduction to algebraic forms.

MA 411 INTRODUCTIONS TO APPLIED MATHEMATICS **3 (3-0) f s**
Prerequisite: MA 301
Infinite series, introduction to Fourier series, special functions defined by integrals, line and multiple integrals, partial differentiation, and a brief treatment of vector analysis.

MA 433 HISTORY OF MATHEMATICS **3 (3-0) s**
Prerequisite: MA 202 or MA 212
Evolution of the number system; trends in the development of modern mathematics; lives and contributions of outstanding mathematicians.

Mr. Nolstad

MA 491 READING IN HONORS MATHEMATICS **2 to 6**
Prerequisite: Membership in Honors Program and permission of Department Chairman.
This is a reading course for exceptionally able students at the junior and senior levels. It will follow the English precedent in university education so that the student will read in some area of advanced mathematics, will present a written report of his reading, and will stand an examination on it.

Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MA 501 NUMERICAL ANALYSIS I **3 (3-0) f s**
Prerequisite: MA 301
Numerical solution of equations, introduction to theory of random errors, least squares and curve fitting, finite-difference tables and the theory of interpolation, numerical integration, numerical differentiation, and elements of difference calculus. Some methods will be presented for use in hand caculations and others for digital computer solution.

Graduate Staff

MA 502 NUMERICAL ANALYSIS II **3 (3-0) s**
Prerequisites: MA 501, MA 511
Summation of series, numerical solution of ordinary differential equations, solution of systems of linear equations, and numerical solution of partial differential equations. Presentation of sources of error in numerical computation and brief analyses will be included in the various numerical procedures.

Graduate Staff

MA 511 ADVANCED CALCULUS I **3 (3-0) f s**
Prerequisite: MA 301, B-average in Mathematics
This two-semester sequence, MA 511 and MA 512, is intended as foundation mathematics for graduate study in Engineering, Physics, or Applied Mathematics. Number system, sequences, limits, continuity; derivatives, differentials. Functions of several variables, limits and continuity, partial differentiation, Jacobians; directional derivatives. Riemann integral, multiple integrals, Green's theorem.

Graduate Staff

MA 512 ADVANCED CALCULUS II **3 (3-0) f s**
Prerequisite: MA 511
Line integrals and applications. Infinite series, review of convergence tests, uniform convergence, powers series and applications. Fourier series. Improper integrals.
Graduate Staff

MA 514 BOUNDARY VALUE PROBLEMS **3 (3-0) f**
Corequisite: 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.
Graduate Staff

MA 517 INTRODUCTION TO TOPOLOGY **3 (3-0) s**
Prerequisite: B+ average in MA 511 and MA 512
A study of basic set-theoretic and general topological notions of modern mathematics. Topics include set theory and cardinal numbers, topological spaces, metric spaces, and elementary discussion of function spaces.

MA 521 ADVANCED GEOMETRY **3 (3-0) f**
Prerequisites: MA 202, MA 405
Coorainates in space; direction angles and cosines; planes, lines, points; matrices. surfaces and curves; quadric surfaces; transformation; analysis of general equation of degree 2; matrix algebra and its applications; introduction to algebraic geometry.
Messrs. Clarkson, Nahikian

MA 522 THEORY OF PROBABILITY I **3 (3-0) s**
Prerequisite: MA 301
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.
Graduate Staff

MA 523 THEORY OF PROBABILITY II **3 (3-0)**
Prerequisites: MA 405, MA 522
Binomial, Poisson, and normal distributions; law of large numbers; recurrent events; renewal theory; Markov chains. Characteristic function and distribution functions; simple stochastic processes. Introduction to game theory and linear programming.
Graduate Staff

MA 532 DIFFERENTIAL EQUATIONS II **3 (3-0) s**
Prerequisite: MA 301, "B" average in mathematics
Solution of second order linear equations with variable coefficients; exact equations; Green's functions; singular points and series solutions; Bessel functions, Legendre polynomials, and other special functions defined by ordinary differential equations; approximate methods; introduction to partial differential equations.
Graduate Staff

MA 535 AN INTRODUCTION TO COMPUTERS **3 (3-0) f s**
Prerequisite: MA 301 and either 405 or one 500-level 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, Wilson

MA 541 VECTOR ANALYSIS **3 (3-0) f s**
Prerequisite: MA 301 and either 405 or one 500-level course
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.
Graduate Staff

MA 543 ELEMENTARY COMPLEX VARIABLE THEORY **3 (3-0) s**
Prerequisite: MA 511 or MA 532
Operations with complex numbers; derivatives, analytic functions, integrals, definitions and properties of elementary functions, multiple-value functions, power series, residue theory and applications, conformal mapping.
Messrs. Bullock, Mumford, 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. Struble

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 system; 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. Struble

MA 608 INTEGRAL EQUATIONS **Alternate Summers 3 (3-0)**
Prerequisites: MA 512, MA 532
Linear Volterra integral equations of the first and second kinds. Relationship to linear differential initial value problems. Special Volterra equations of the convolution type. Singular Volterra equations. Linear Fredholm integral equations of the first and second kind. Basic theory. Symmetric kernels. Hilbert-Schmidt theory (generalizations).

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.
Mr. Bullock

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 615 THEORY OF FUNCTIONS OF A REAL VARIABLE I **Alternate Years 3 (3-0) f**
Prerequisite: MA 512
Sets and spaces; continuity and differentiability of real functions.
Messrs. Harrington, Kassimatis

MA 616 THEORY OF FUNCTIONS OF A REAL VARIABLE II **Alternate Years 3 (3-0) s**
Prerequisite: MA 615
Measure, measurable sets and functions, theory of Lebesque integration.
Messrs. Harrington, Kassimatis

MA 621 INTRODUCTION TO MODERN ABSTRACT ALGEBRA **3 (3-0) f**
Prerequisite: MA 512
A study of the abstract structure and properties of groups, rings and ideals, and fields.
Messrs. Nahikian, Park

MA 622 VECTOR SPACES AND MATRICES **3 (3-0) s**
Prerequisite: MA 511
Introduction to matrices; vector spaces; equivalence, rank, inverse of matrices; determinants; congruence; gradratic forms; polynomials over a field; similarity; characteristic roots.
Messrs. Nahikian, Park

MA 625 INTRODUCTION TO DIFFERENTIAL GEOMETRY **Aleternate Summers 3 (3-0)**
Prerequisite: MA 512
Theory of curves and surfaces in 3-dimensional euclidean space with special reference to those properties invariant under the rigid body motions.
Messrs. Levine, Winton

MA 632 OPERATIONAL MATHEMATICS I **3 (3-0) f**
Corequisite: MA 543 or MA 611
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; other infinite and finite transforms and their applications.
Mr. Cell

MA 635 MATHEMATICS OF COMPUTERS **3 (3-0) s**
Prerequisites: MA 502, MA 512, MA 535; Corequisite: MA 405 or 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 **Alternate Summers 3 (3-0)**
Prerequisite: MA 512
The simplest problem of the calculus of variations in detail; 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 **Alternate Summers 3 (3-0)**
Prerequisites: MA 611, 633 or equivalent
Expansion of functions of one or more variables in Taylor series; asymptotic series, infinite products, partial fractions, continued fractions, series of orthogonal functions; applications in ordinary partial differential equations, difference equations and integral equations.

Messrs. Cell, Harrington

MA 661 TENSOR ANALYSIS I **3 (3-0) f**
Prerequisites: MA 512, MA 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, Riemannian 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, dynamics 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 fluid, viscosity tensor, equations of motion; electromagnetic theory. Maxwell's equations, plane waves, stress-energy tensor.

Mr. Levine

MA 681 SPECIAL TOPICS IN ANALYSIS **up to 6 hours credit**

MA 683 SPECIAL TOPICS IN ALGEBRA **up to 6 hours credit**

MA 685 SPECIAL TOPICS IN NUMERICAL ANALYSIS **up to 6 hours credit**

MA 687 SPECIAL TOPICS IN GEOMETRY **up to 6 hours credit**

MA 689 SPECIAL TOPICS IN APPLIED MATHEMATICS **up to 6 hours credit**
The above courses, MA 681-MA 689, afford opportunities for graduate students to study advanced topics in mathematics under the direction of members of the graduate staff. These will on occasion consist of one of several areas such as, for example, advanced theory of partial differential equations, topology, mathematics of plasticity or of viscoelasticity, mathematics of orbital mechanics.

MA 691 RESEARCH IN MATHEMATICS **Credits by arrangement**
Prerequisite: Graduate standing and approval of adviser
Individual research in the field of mathematics.

MECHANICAL ENGINEERING

COURSES FOR UNDERGRADUATES

ME 101, ME 102 ENGINEERING GRAPHICS I, II **2 (1-3) f s**
Corequisite: MA 101, or MA 111
The objective of these courses is to teach the student the proper methods, techniques, and procedures of expression and interpreting data in this medium of communication. Theories and common practices are used to emphasize instrument practice, geometrical construction, freehand technical sketching, completion of prepared worksheets, sections, projections, auxiliary views, pictorial views, diagramatic sketches and drawings using standard symbols, charts and graphs, and blueprint reading. Special emphasis will be placed upon visualization in the analysis and solution of geometrical magnitudes represented by points, lines, planes, and solids; intersection and development of flat and curved surfaces.

ME 301 ENGINEERING THERMODYNAMICS I **3 (3-0) f s**
Prerequisites: MA 202, PY 201
A study of energy and energy transformations; the First and Second Laws applied to systems and to control volumes; thermodynamic properties of systems; property changes occurring resulting from charges in state; availability of energy.

ME 302 ENGINEERING THERMODYNAMICS II **3 (3-0) s**
Prerequisite: ME 301
A continuation of engineering thermodynamics I for Mechanical Engineering juniors. Thermodynamics of mixtures; chemical thermodynamics; thermodynamics of fluid flow; vapor and gas cycles; applications to compressors, internal combustion engines, steam and gas turbines, refrigeration.

ME 303 ENGINEERING THERMODYNAMICS III **3 (3-0) s**
Prerequisite: ME 301
A continuation of engineering thermodynamics I for Non-Mechanical Engineering juniors. Thermodynamics of mixtures; thermodynamics of fluid flow; heat transfer; vapor and gas cycles and applications.

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 EXPERIMENTAL MECHANICAL ENGINEERING I **1 (0-3) f**
Corequisite: ME 301
Theory and principles involved in instrumentation and measurements. Limitation and sources of error of each technique studied. Utilization of instrumentation in predetermined situations that exhibit the essential characteristics of the instrumentation. Consideration of transient and steady state techniques. Areas of study; pyrometric measurements, piezo measurements and measurements of flow properties.

ME 306 EXPERIMENTAL MECHANICAL ENGINEERING II **1 (0-3) s**
Prerequisite: ME 305; Corequisites: EM 321, ME 312
A continuation of ME 305 with emphasis on measurements of kinematic quantities, measurements of thermophysical properties and energy measurements. Treatment of experimental data.

ME 311 KINEMATICS **3 (3-0) f**
Corequisite: EM 312
Required of juniors in Mechanical Engineering
The application of the principles of kinematics to the field of Mechanical Engineering.

ME 312 DYNAMIC ANALYSIS **3 (3-0) s**
Prerequisites: ME 311, MA 301
Required of juniors in Mechanical Engineering
The application of rational dynamics to the field of Mechanical Engineering; the science of motions resulting from any force, and of the forces required to produce motions.

ME 351 ELEMENTS OF AERONAUTICAL ENGINEERING **3 (3-0) f**
Prerequisites: MA 202, PY 202
Corerequisite: 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**
Prerequisites: ME 351, MA 301
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 381, 382 AIR CONDITIONING I, II **3 (3-0) s f**
Prerequisite: ME 301
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 s**
Prerequisite: ME 302
Required of seniors in Mechanical Engineering
A study of the basic technical principles of the transformation of energy into useful forms and the study of the fundamental sciences leading to engineering decisions of selection and arrangement of energy transforming equipment. Various types and kinds of plants. Energy balance and significance upon the proper selection of elements in the power plant. Economic selection of components. Factors affecting the cost of power and the elements which enter into the problems arriving at monetary electric rates.

ME 405 EXPERIMENTAL MECHANICAL ENGINEERING III **1 (0-3) f**
Prerequisite: ME 306
Experimental analysis of engineering systems. Selection of appropriate instrumentation and analysis of predetermined small scale engineering systems designed for flexibility and wide variation of parameters. Experiments cover the gamut of mechanical engineering activity.

ME 406 EXPERIMENTAL MECHANICAL ENGINEERING IV **1 (0-3) s**
Prerequisite: ME 405
Individual or small group investigation of an original problem. A project type of program.

ME 410 JET PROPULSION **3 (3-0) s**
Prerequisites: 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 MACHINE DESIGN I **3 (3-0) f**
Prerequisites: ME 312, EM 321
Required of seniors in Mechanical Engineering
Basic principles of the mechanical sciences applied to the analysis of machines, devices, and mechanical systems. State of stress, state of strain, elasticity, working stresses, stress concentration, fatigue, impact and shock, plasticity, thermal stress, wear, lubrication and contact stress.

ME 412 MACHINE DESIGN II **3 (3-0) s**
Prerequisite: ME 411
Required of seniors in Mechanical Engineering
Synthesis of machines, devices, and machanical systems. The specification of systems, formulation of region of design, synthesis of elements, complete analysis of the ensemble, evaluation and closure of the design. Project activity with research emphasis.

ME 435 INDUSTRIAL AUTOMATIC CONTROLS **3 (3-0) f or s**
Prerequisites: ME 301, MA 301
Introduction to concept of automatic controls; fundamentals of two-position, proportional, floating and rate modes of control with a graphical and analytical presentation of each. Theoretical considerations of the process and an introduction to system analysis.

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 352
Determination of design data, tunnel wall and ground effect interference corrections, spanwise and chordwise load distributions, performance estimation, and stabilty and control analysis. Attention is given to transonic and supersonic aerodynamics.

ME 455, 456 AERONAUTICAL LABORATORY I, II **1 (0-3) f s**
Prerequisite: ME 351
Demonstration of wind tunnel testing methods and principles of fluid motion. Aerodynamic tests of airplane components and complete models. Calbiration of instruments and other laboratory exercise 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 **2 (3-0) f**
Prerequisite: ME 302
The fundamental principles of refrigeration, the performance of various types of refrigerating machines and their applications to air conditioning; controls of such systems.

ME 481, 482 AIR CONDITIONING DESIGN I, II **3 (1-6) f s**
Prerequisite: ME 381
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.

ME 502 HEAT TRANSFER **3 (3-0) f or s**
Prerequisites: ME 301, MA 301
A study of the fundamental laws of heat transfer by conducting convection and radiation; steady and unsteady states heat transfer.

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, precombustion, and scavenging as applied to reciprocating and rotary engines.

ME 515 EXPERIMENTAL STRESS ANALYSIS **3 (2-3) f**
Prerequisite: ME 312
Theoretical and experimental techniques of strain and stress analysis, with experimental emphasis on electrical strain gages and instrumentation, brittle coatings, grid methods, and photoelasticity. Laboratory includes a full experimental investigation and report of a problem chosen by the student under the guidance of the instructor.

ME 516 PHOTOELASTICITY **3 (2-3) s**
Prerequisite: ME 515
Two and three-dimensional photoelasticity; the stress-optic law, isochromatics, isoclinics, stress trajectories, fractional orders of interference; three dimensional techniques, oblique incidence, rotational and thickness effects; determination of principal stresses at interior points; laboratory investigations.

ME 517 LUBRICATION **3 (2-3) s**
Prerequisite: EM 430
The theory of hydrodynamic lubrication; Reynolds' equation, the Sommerfeld integration, effect of variable lubricant properties and energy equation for temperature rise. Properties of lubricants. Application to design of bearings. Boundary lubrication.

ME 521 AEROTHERMODYNAMICS **3 (3-0) f or s**
Prerequisites: ME 301, MA 301, EM 430
An examination of the basic concepts of gas dynamics such as the continuum, domain of applicability of continuum, acoustic velocity, compressibility effects, and the conservation laws. Analysis of one dimensional flows such as isentropic flow, diabatic flow, flow with friction, the normal shock. An introduction to the vector formulation of multidimensional problems.

ME 545, 546 PROJECT WORK IN MECHANICAL ENGINEERING I, II **2 (0-4) f or s**
Individual or small group investigation of a problem stemming from a mutual student-faculty interest. Emphasis is placed on providing a situation for exploiting student curiosity.

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 453
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**
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
A fundamental study of summer and winter air conditioning including temperature, humidity, air velocity and distribution.

ME 572 REFRIGERATION **3 (3-0) s**
Prerequisite: ME 302
A thermodynamic analysis of the simple, compound, centrifugal and multiple effect compression systems, the steam jet system and the absorption system of refrigeration.

COURSES FOR GRADUATES ONLY

ME 601 ADVANCED ENGINEERING THERMODYNAMICS **3 (3-0) f**
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 602 STATISTICAL THERMODYNAMICS **3 (3-0) s**
Prerequisites: ME 601, MA 511
Fundamental principles of kinetic theory, quantum mechanics, statistical mechanics and irreversibly phenomena with particular reference to thermodynamic systems and processes. The conclusions of the classical thermodynamics are analyzed and established from the macroscopic viewpoint.

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 605 AEROTHERMOCHEMISTRY **3 (3-0) s**
Prerequisites: ME 601, MA 511 or equivalent
A generalized treatment of combustion thermodynamics including derivation of thermodynamics quantities by the method of Jacobians, criteria for thermodynamic equilibrium, computation of equilibrium composition and ediabatic flame temperature. Introduction to classical chemical kinetics. Conservation equations for a reacting system, detonation and deflagration. Theories of flame propagation, flame stabilization, and turbulent combustion.

ME 606 ADVANCED GAS DYNAMICS **3 (3-0) s**
Prerequisites: ME 521, ME 601, MA 511
The general conservation equations of gas dynamics from a differential and integral point of view. Hyperbolic compressible flow equations, unsteady one-dimensional flows, the non-linear problem of shock wave formation, isentrophic plane flow, flow in nozzles and jets, turbulent flow.

W. T. Snyder

ME 608 ADVANCED HEAT TRANSFER I **3 (3-0) f**
Prerequisite: ME 502 or equivalent
Fundamental aspects, from an advanced viewpoint, will be considered in the conduction of heat through solids, convective phenomena, and the measurement and prediction of appropriate physical properties. Boundary value problems arising in heat conduction will be examined and both numerical and function solution techniques developed. Internal and external boundary layer analyses will be made on a variety of representative convection situations.

ME 609 ADVANCED HEAT TRANSFER II **3 (3-0) s**
Prerequisite: ME 608
Advanced topics in the nonisothermal flow of fluids through channels will be investigated for slug, laminar, transitional and turbulent conditions. The influence of mass transfer on flow and heat transfer processes will be considered. Radiation exchange processes between solid surfaces and solid surfaces and gasses both stationary and moving will be discussed.

ME 611, 612 ADVANCED MACHINE DESIGN I, II **3 (3-0) f s**
Prerequisite: ME 412
Kinematics of mechanical media, the stress tensor, the tensor of strains, elasticity, plasticity, time-dependent behavior; theories of failure, working stresses; shock and steady dynamic loading, creep, stress concentration, thermal stress, contact stresses; energy theories, finite difference and relaxation methods, hydrodynamic lubrication. Application to the design of machine frames, shafts, bearings, gears, springs, cams, etc.

ME 613 MECHANICS OF MACHINERY **3 (3-0) f**
Prerequisites: ME 312, MA 512
Vector dynamics, d'Alembert's principle, Lagrange's equations; rigid kinematics, Euler's angles, rigid rotation, Coriolis accelerations; the inertia tensor. Application to mechanisms, gyroscopes, guidance and control systems, rotating and reciprocating devices.

ME 614 MECHANICAL TRANSIENTS AND MACHINE VIBRATIONS **3 (3-0) s**
Prerequisites: ME 312 or EM 545, MA 512
Dynamic loads in mechanical media are considered in two categories—steady vibrations and transient shock and impact. The Lagrange equations and the wave equation are employed to study internal stresses and displacements in mechanical devices which result from such loading.

ME 617 PLATES AND SHELLS IN MECHANICAL DESIGN **3 (3-0) s**
Prerequisites: MA 511, ME 611
The concept of members which are thin in one dimension, that is, plates and shells, is applied to mechanical design with particular emphasis on type of loading, conditions of service, and compliance of the members to its environment.

ME 641, 642 MECHANICAL ENGINEERING SEMINAR I, II **1 to 3 credits f or s**
Faculty and graduate student discussions centered around current research problems and advanced engineering theories.

ME 645 MECHANICAL ENGINEERING RESEARCH **3 to 6**
Prerequisite: Graduate standing in ME and approval of advisor
Individual research in the field of Mechanical Engineering

ME 651 PRINCIPLES OF FLUID MOTION **3 (3-0) f**
Prerequisite: ME 453 or equivalent; Corequisite: 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 pheonomena 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, shock wave theory, methods of observation, and flows of transonic speeds.

ME 653 SUPERSONIC AERODYNAMICS **5 (5-0) f**
Prerequisite: ME 652
Equations of motion in supersonic flow, Prandtl-Meyer turns, method 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 660 AERO-MECHANICAL ENGINEERING PROBLEMS **3 (3-0) s**
Prerequisites: ME 502, MA 514, 543 or equivalent
Derivation of governing equations and set-up of representative problems in heat transfer, gas dynamics and magneto-hydrodynamics; review of techniques for solving these problems. Introduction of other techniques such as method of steepest descent, method of Weiner-Hopf. variational methods and others. Phase-space and function space concepts will be introduced also. Purpose of the course in the graduate program to strengthen the analytical techniques of the students in dealing with aero-mechanical engineering problems so that in their later studies more emphasis may be put on formulation of new problems and physical interpretation of new results.

J. T. Yen

ME 671, 672 ADVANCED AIR CONDITIONING DESIGN I, II **3 (3-0) f s**
Prerequisites: ME 571, ME 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 solution, 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**
Corequisite: MIM 421 or MIM 422
Laboratory work to accompany Metallurgy I, II

MIM 431, 432 METALLOGRAPHY I, III **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 MIM 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 ink 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 metalic corrosion and passivity. The electrochemical nature of corrosive attack, basic forms of corrosion, corrosion rate factors, methods of corrosion protection. Laboratory work included.

MIM 545, 546 ADVANCED METALLURGICAL EXPERIMENTS I, II **3 (1-6) f s**
Prerequisite: MIM 422 or approval of instructor
Advanced engineering principles applied to a specific experimental metallurgical project. A seminar period is provided and a written report is required.

MIM 561 ADVANCED STRUCTURE AND PROPERTIES OF MATERIALS **3 (2-3) f**
Prerequisite: MIM 422
materials of construction for nuclear reactors. Lecture and laboratory.

MIM 562 MATERIALS PROBLEMS IN NUCLEAR ENGINEERING **3 (2-3) s**
Prerequisite: MIM 561
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 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

THE BASIC COURSE

MS 101 MILITARY SCIENCE I **1 (1-1) f**
Classroom instruction is given in organization of the Army, and in individual weapons and marksmanship. On the drill field, emphasis is placed on development of teamwork, esprit de corps, and essential characteristics of leadership.

MS 102 MILITARY SCIENCE I **1 (1-1) f**
Prerequisites: MS 101 or equivalent credit.
Classroom instruction is given in the role of United States Army and National Security. On the drill field, emphasis is placed on development of teamwork, esprit de corps, essential characteristics of leadership.

MS 201 MILITARY SCIENCE II **1 (0-3) f**
Prerequisites: MS 101, MS 102 or equivalent credit.
Classroom instruction in map and aerial photograph reading, and the role of the U. S. Army in national security. On the drill field emphasis is placed on development of teamwork, esprit de corps, essential characteristics of leadership, and acceptance of responsibility.

MS 202 MILITARY SCIENCE II **1 (0-3) s**
Prerequisites: MS 101, MS 102 or equivalent credit.
Classroom instruction in basic tactics employed by small units.
On the drill field emphasis is placed on development of teamwork, esprit de corps, essential characteristics of leadership, and acceptance of responsibiltiy.

THE ADVANCED COURSE

MS 301 MILITARY SCIENCE III **1 (0-3) f**
Prerequisites: MS I and II or equivalent credit.
Classroom instruction is given in the principles of military planning and conduct of offensive and defensive tactics. This study includes communications in support of military operations. Practical leadership instruction is provided on the drill field where emphasis is placed on acceptance of responsibility, exercise of command, and development of self-confidence, initiative and dignity in appearance and demeanor.

MS 302 MILITARY SCIENCE III **2 (2-1) s**
Prerequisite: MS 301.
Classroom instruction is given in missions and functions of the combat arms and technical services; military leadership, emphasizing the factors controlling the soldier's behavior and the problems of command; methods in military teaching with special reference to the leader's responsibility for soldier's learning. Practical leadership instruction is provided on the drill field where emphasis is placed on acceptance of responsibility, exercise of command and development of self-confidence.

MS 401 MILITARY SCIENCE IV **1 (2-1) f**
Prerequisites: MS III, satisfactory completion of six weeks, summer camp training.
Classroom instruction is given in military justice, troop movement, logistics, and operations. On the drill field, emphasis is placed on the 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.

MS 402 MILITARY SCIENCE IV **2 (2-1) s**
Prerequisites: MS III, satisfactory completion of six weeks' summer camp training.
Classroom instruction is given in supply and evacuation, Army administration, role of the United States in world affairs, and service orientation. On the drill field, emphasis is placed on the 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.

MINERAL INDUSTRIES

SEE CERAMIC ENGINEERING

SEE GEOLOGICAL ENGINEERING

SEE METALLURGICAL ENGINEERING

MODERN LANGUAGES

Courses numbered 200 and above 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, ML 102 or equivalent
Selected readings from literary French. Attention given to the attainment of skill in reading and comprehension.

ML 202 FRENCH CIVILIZATION **3 (3-0) f s**
Prerequisites: ML 101, ML 102 or equivalent
Special emphasis given to translating from French. 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, ML 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, ML 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 CIVILIZATION **3 (3-0) f s**
Prerequisites: ML 103, ML 104 or equivalent
Attention given to translation from German. 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 503 GERMAN GRAMMAR FOR GRADUATE STUDENTS **3 (3-0) f s**
This course is open to Graduate Students and Senior Honor Students 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 CIVILIZATION **3 (3-0) f s**
Prerequisites: ML 105, ML 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 HISPANO-AMERICAN CIVILIZATION **3 (3-0) f s**
Prerequisites: ML 105, ML 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 205, ML 206 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 problems 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**
Basic structure of the language, supplemented by easy readings.

ML 111 RUSSIAN GRAMMAR AND PROSE READING **3 (3-0) f s**
Prerequisite: ML 110
A course for students who wish to attain proficiency in reading Russian. Attention given to basic grammar and the use of the written language.

ML 211 RUSSIAN PROSE: SELECTIONS FROM RUSSIAN LITERATURE **3 (3-0) f s**
Prerequisite: ML 110, ML 111, or equivalent
Selceted readings from Russian literature. Grammar review and emphasis on vocabulary building and improvement in reading and speaking ability.

ML 212 RUSSIAN CIVILIZATION **3 (3-0) f s**
Prerequisites: ML 110, ML 111
Reading in Russian covering the history, politics, customs, and culture of Russia. Emphasis given to accurate translation from Russian to English. Parallel readings and reports.

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.

NUCLEAR ENGINEERING

NE 530 (PY 530) ELEMENTARY NUCLEAR REACTOR THEORY **3 (3-0) s**

NE 531 (PY 531) NUCLEAR REACTOR LABORATORY **1 (0-3) f s**

NE 619 (PY 619) HETEROGENEOUS REACTOR DESIGN **3 (3-0) f**

NE 620 (PY 620) NUCLEAR RADIATION ATTENUATION **3 (3-0) s**

NE 630 (PY 630) HOMOGENEOUS REACTOR DESIGN **3 (3-0) s**

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 reflective habits.

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, philosophy, and religion; the rational foundations of theism; the concept of God in Western thought.

PHI 306 PHILOSOPHY OF ART **3 (3-0) f s**
Study of historical and contemporary theories of art; development of coherent set of concepts for analysis and discussion of esthetic experience, critical judgments, works of art and their relations to other aspects of culture.

PHI 307 ETHICS **3 (3-0) f s**
Study of major ethical theories; attempts systematic analysis of the nature of value judgments, the concepts of moral obligation, right and good.

PHI 309 MARRIAGE AND FAMILY LIVING **3 (3-0) f s**
Secular and religious concepts of marriage; physical, socio-phychological, and ethical aspects of premarital and marital relationships; parenthood; systematic analysis of value judgments relative to marriage and family living; formulation of 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; evaluation of prevalent theories of husband-wife, and parent-child relationships.

PHI 395 PHILOSOPHICAL ANALYSIS **3 (3-0) f s**
Semantical, logical, and experiential methods of investigation; intensive application of critical inquiry to a few fundamental problems including the nature of knowledge and its validation, and value judgement; major objective to afford the student personal participation in the acquaintance with philosophical analysis as intellectual tool with wide applicability.

PHI 401 SYMBOLIC LOGIC **3 (3-0) f s**
Modern methods in logic involving formalized expression that avoids the inherent difficulties and ambiguities of ordinary language and makes possible greater exactness and effectiveness in handling complex material.

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.

PHI 405 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.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

REL 502 PROBLEMS OF RELIGION **3 (3-0) f s**
Prerequisite: Six term credits in Religion or related fields.
Major trends in contemporary theology; significance of the resurgent interest in religion and the growth of the church in recent times; problem of communication between theology and science; 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 education 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 basis 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.

REQUIREMENTS 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.

SPEEDBALL: Offered in the fall and spring semesters. A course designed to teach the fundamental skills, 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 fundamentals, 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 (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.

CROSS COUNTRY: Offered both fall and spring semesters. A course designed to develop knowledge, skill, and interest in cross-country.

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 first half of the spring semester. A course designed to include the fundamentals of gymnastics on the parallel bars, side horse, trampoline, and mats.

HANDBALL: Offered in both fall and spring semesters. A course designed to include the fundamentals, together with history and rules of handball.

RIFLERY: Offered in the last half of the fall semester and the first half of the spring semester. A course designed to teach safety and skill with firearms during the three basic positions of shooting.

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.

SQUASH: Offered in both fall and spring semesters. A course designed to include the fundamentals, together with history and rules of squash.

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 INSTRUCTORS): 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 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 etiquete.

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 following varsity sports: baseball, basketball, cross-country track, football, golf, soccer, swimming, track, and wrestling.

PHYSICS

COURSES FOR UNDERGRADUATES

PY 201, 202 GENERAL PHYSICS **5 (3-4) f s; f s**
Corequisite: MA 201
Required of sophomores in Sciences, Mathematics, and Engineering. A study of classical and modern physics in which the analytical approach is employed. Emphasis is placed on the understanding of fundamental facts and principles, and on the solution of problems. The MKS system of units is used, and calculus is applied as needed. Demonstration lectures, recitations, problem drill and laboratory work are coordinated to give a working knowledge of basic principles. 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
A survey of general physics designed to provide a practical understanding of the fundamentals on which technology is based. Recitations, demonstrations, and laboratory work. PY 211, mechanics and heat; PY 212, sound, light, and electricity.

PY 221 COLLEGE PHYSICS **5 (5-0) f s**
Prerequisite: MA 111
Required in certain curricula of the School of Agriculture. An introduction to the origins of physical science, the fundamental principles of physics, and the many applications to modern technology. The important concepts in the classical areas of mechanics, heat, sound, electricity and magnetism, and light are presented, along with discussion of modern atomic physics. Lectures and demonstrations with class participation.

PY 223 ASTRONOMY AND ASTROPHYSICS **3 (3-0) s**
Prerequisite: PY 212 or PY 202
An introduction to descriptive and physical astronomy, with attention to the solar system, constellations, and star groups. The physical aspects of stars, such as brightness, temperatures, energy and composition, are reviewed, along with the development of theories of galaxies and the universe. The nature of fusion sources of energies in stars is discussed. Observations are made with the 5-inch refracting telescope as part of the course.

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
A treatment of the general principles of photography with special applications in the fields of spectrography, micrography, Roentgenology, and nuclear physics.

PY 401 MECHANICS **4 (3-3) f**
Prerequisite: PY 202; Corequisite: MA 301
An intermediate course in theoretical mechanics. Statics and dynamics of particles and rigid bodies. Lectures, problems, recitations with one laboratory per week.

PY 402 HEAT AND SOUND **4 (3-3) s**
Prerequisite: PY 202; Corequisite: MA 301
An intermediate course in the principles of thermodynamics, kinetic theory, heat transfer and vibration. Lectures, problems, recitations, with one laboratory per week.

PY 403 ELECTRICITY AND MAGNETISM **4 (3-3) f**
Prerequisite: PY 202; Corequisite: MA 301
An intermediate course in the fundamentals of static and dynamic electricity and electromagnetic theory. Lectures, problems, recitation with one laboratory per week.

PY 404 OPTICS **4 (3-3) s**
Prerequisite: PY 202; Corequisite: MA 301
An intermediate course in physical and geometric optics. Lectures, problems, recitations, with one laboratory per week.

PY 407 INTRODUCTION TO MODERN PHYSICS **3 (3-0) f s**
Prerequisites: PY 202; MA 202
A survey of the important developments in atomic and nuclear physics of this century. Among topics covered are: atomic and molecular structure, determination of properties of ions and fundamental particles, the origin of spectra, cosmic rays, ion accelerators and nuclear reactions.

PY 410 NUCLEAR PHYSICS I **4 (3-3) f s**
Prerequisite: PY 407
An introduction to the properties of the nucleus, the interaction of radiation with matter. A quantitative description is given of natural and artificial radioactivity, nuclear reactions, fission, fusion, and the structure of simple nuclei. Lectures and laboratory.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PY 501 WAVE MECHANICS **3 (3-0) f**
Prerequisites: PY 407, MA 301
An introduction to the foundations of quantum and wave mechanics, with solutions of the problem of the free particle, harmonic oscillator, rigid rotating molecule, and the hydrogen atom. Approximation methods are developed for more complex atomic systems.

PY 503 INTRODUCTION TO THEORETICAL PHYSICS **3 (3-0) s**
Prerequisites: PY 401 or PY 403, MA 541
An introductory course which offers preparation necessary for advanced graduate study. This course presented from the viewpoint of vector and tensor calculus, includes: particle dynamics, La grange's equations of motion, Hamilton's principle, mechanics of rigid bodies, topics in electromagnetic theory and relativity, with an elementary treatment of the motion of charged particles.

PY 507 ADVANCED ATOMIC PHYSICS **3 (3-0) f**
Prerequisites: PY 401, PY 403, PY 407, MA 401
Statistical theory of matter; derivations of Maxwell, Fermi, and Bose distributions; distributions in potential fields; distinction between metals, insulators, semi-metals, and semiconductors; thermionic, field, photo, and secondary emissions from metals; effects of absorbed films on surfaces; electronic and ionic collisions in un-ionized and in ionized gasses; ionization and recombination in gases and at surfaces; optical excitation, absorption, and spontaneous and induced emission; bremsstrahlung; Cerenkov radiation; mass spectrometry; space change in vacuum and dimensional similitude; space charge in low density ionized gases, and some examples; magnetic self-focusing in streams; relativistic streams.

PY 510 NUCLEAR PHYSICS II **4 (3-3) s**
Prerequisite: PY 410
The description and analysis of nuclear energy levels, meson theory, nuclear resonance, atomic and molecular magnetism and cosmic radiation. Principles and experiments in neutron physics are discussed. Emphasis is placed on experience in independent research in the laboratory work.

PY 518 RADIATION HAZARD AND PROTECTION **3 (3-0) f s**
Prerequisite: PY 410
The hazards from external exposure to ionizing radiation are evaluated, and the factors influencing dosage due to internal exposure are investigated. Methods of providing protection in research or large-scale use of radioactive elements are analyzed.

PY 520 PHYSICAL MEASUREMENTS IN RADIOACTIVITY **3 (2-3) f s**
Prerequisite: PY 410
The principles of experimental measurements on radioactive materials are presented and demonstrated through laboratory work. Emphasis is placed on preparation of samples for precise quantitative study, detection of radiations, and analytical interpretation of experimental data.

PY 526 IONIZATION PHENOMENA AND ELECTRON OPTICS **2 (2-0) s**
Prerequisites: PY 404, PY 410
Investigation of plasma phenomena, including ion production, recombination, radiation, instabilities, and confinement by electromagnetic fields. A review of the problems, progress, and status of thermonuclear research.

PY 530 INTRODUCTION TO NUCLEAR REACTOR THEORY **3 (3-0) s**
Prerequisites: PY 410; MA 511 or MA 532
The principles of neutron motion in matter, with emphasis on the analysis of the nuclear chain reactor. Slowing of neutrons, diffusion, space distributions of flux, conditions for criticality, group theories, and the time dependent behavior of fissionable assemblies.

PY 531 NUCLEAR REACTOR LABORATORY **1 (0-3) f s**
Corequisite: PY 530, PY 518 except by permission.
Observation and measurements of static and dynamic nuclear reactor behavior, the effectiveness of control and temperature, and correlation with theory. Experiments on the motion and detection of neutrons and gamma rays, with emphasis on the research uses of nuclear reactor radiations.

PY 541 ADVANCED EXPERIMENTS IN PHYSICS **1 (0-3) f s**
Prerequisites: PY 202, MA 202
Covers the technique 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 301
The dynamics of vibratory and oscillatory motion. Analogies in mechanical, electrical and acoustical virbrating systems. Analysis of wave motion and propagation in different media.

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, transducers, 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
The origin, production and absorption of x-rays are studied, the single-crystal and powder diffraction methods are presented and applied in the laboratory to the study of crystal structure, metallurgical defects and fiber and particle size.

PY 522 INTRODUCTION TO THE STRUCTURE OF SOLIDS, CRYSTALLOGRAPHY **3 (3-0) s**
Prerequisites: PY 202, MA 202, PY 551 recommended
Basic considerations of amorphous and crystalline solids, metals, conductors and semiconductors. Introduction to optical crystallography.

PY 601, 602 ADVANCED GENERAL PHYSICS **3 (3-0) f s**
Prerequisite: PY 503, Corequisite: MA 661
Mathematical and theoretical approach to relationships between the various branches of physics, with applications to mechanical, electrical, optical, thermal, and vibratory problems. The restricted theory of relativity, electrodynamics, the theory of electrons, classical field theory, and the general theory of relativity.

PY 610 ADVANCED NUCLEAR PHYSICS **3 (3-0) f**
Prerequisites: PY 410, PY 611 except by permission
Current hypotheses of nuclear structure and reactions including deuteron binding, neutron-proton scattering, the compound nucleus, stripping reactions, shell structure, beta decay, neutron resonances and mesons. The use of neutrons in present-day nuclear research is emphasized.

PY 611 QUANTUM MECHANICS **3 (3-0) f**
Prerequisites: PY 501, MA 512
Theory of quantum mechanics with applications to atomic and molecular structure, scattering phenomena, and a semi-classical treatment of the interaction of radiation with matter.

PY 612 ADVANCED QUANTUM MECHANICS **3 (3-0) s**
Prerequisites: PY 601, PY 611
Dirac's relativistic electron theory, elementary scalar and vector meson field theory. Introduction to quantum electrodynamics and the general theory of quantized fields.

PY 619 REACTOR THEORY AND ANALYSIS I **3 (3-0) f**
Prerequisite: PY 530
The theory of neutron slowing, resonance capture, Doppler effect, and thermal flux distributions in heterogeneous nuclear reactors. Analysis of reactor control by temperature, effects of localized and distributed absorbers, fission products, fuel consumption and production. One-velocity neutron transport theory.

PY 620 NUCLEAR RADIATION ATTENUATION **3 (3-0) s**
Prerequisites: PY 503, MA 532
Physical theory of neutron and gamma-ray behavior in matter. Calculations of source terms, attenuation factors, heating rates, geometrical transformations and radioactive decay effects required in the design of nuclear radiation shields. Transport theory of gamma-ray and neutron transmission through matter. Analysis of experimental techniques for obtaining shielding data.

PY 621 KINETIC THEORY OF GASES **3 (3-0) f**
Prerequisites: PY 503, MA 511
The theory fo 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 501, MA 511, PY 621 except by permission.
A treatment of statistical mechanics from both the classical and quantum point of view. Development of thermodynamic theories and application to atomic systems.

PY 626 PLASMA PHYSICS **3 (3-0) s**
Prerequisite: PY 503, PY 507, PY 526
Particle motion in electric and magnetic fields; guiding center; drift motions; effect of collisions upon charged particles moving through ionized gases; electrical conductivities in ionized gases in electric and magnetic fields; run-away electrons; diffusion; relaxation; thermal conductivity; electric and magnetic susceptibilities; Van Leeuwen's theorem; magnetic pressure; waves in plasmas; astrophysical approximations and concepts; confinement of thermonuclear plasmas; propulsion of plasmas; instabilities in plasmas; streaming instabilities; plasma thermocouple, shock formation and properties.

PY 630 REACTORS THEORY AND ANALYSIS II **3 (3-0) s**
Prerequisite: PY 530
The theory of neutron multiplication in uniform media, with several dimensions, regions and neutron energy groups. Reactor control by absorbers, time dependent reactor behavior, matrix treatment of perturbation theory, neutron thermalization by interaction with moving nuclei, energy dependent neutron transport theory and multigroup machine methods.

PY 631, 632 ATOMIC AND MOLECULAR SPECTRA **3 (3-0) f s**
Prerequisite: PY 501 Corequisites: 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 501 or PY 611
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: (a) general physics and nuclear science, (b) nuclear physics, (c) ionic phenomena of space physics, (d) developments in plasma physics, (e) non-inertial space mechanics, and (f) developments in field theory.

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**
Prerequisite: BO 103
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**
Prerequisite: BO 103
The nature and symptoms of major types of tree diseases and the important characteristics of their casual 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 500 ADVANCED PLANT PATHOLOGY **2 (2-0) s**
Prerequisite: PP 315 or equivalent
An advanced study of the economic importance, symptoms, disease cycles, epiphytology, and control of major groups of plant diseases. Students who register for this course are also required to register for either PP 501 or PP 502, or they may register for both.
Mr. Winstead

PP 501 ADVANCED PLANT PATHOLOGY LABORATORY-FIELD CROPS DISEASES **1 (0-3) s**
Prerequisite: PP 315 or equivalent
Laboratory course for students whose major interest is diseases of field crops to accompany lecture course in advanced plant pathology (PP 500). Diseases will be selected for study which are important on field crops. Either this course or PP 502 must be taken concurrently with PP 500.
Mr. Kline

PP 502 ADVANCED PLANT PATHOLOGY LABORATORY-HORTICULTURE CROPS DISEASES **1 (0-3) s**
Prerequisite: PP 315 or equivalent
Laboratory course for students whose major interest is diseases of horticulture crops to accompany lecture course in advanced plant pathology (PP 500). Diseases will be selected for study which are important on fruit, ornamental and vegetable crops. Either this course or PP 501 must be taken concurrently with PP 500.
Mr. Winstead

PP 503 DIAGNOSIS OF PLANT DISEASES **Summer session 3 (1-4)**
Prerequisites: One advanced course in Plant Pathology, 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 1960 and alternate years)
Mr. Hebert

COURSES FOR GRADUATES ONLY

PP 601 PHYTOPATHOLOGY I **4 (1-6) f**
Prerequisite: PP 315, 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 presentation of data.
Mr. Apple

PP 602 PHYTOPATHOLOGY II **4 (2-6) s**
Prerequisite: PP 315, permission of the instructor
The basic concepts of the etiology, pathology, epiphytology, and control of plant diseases.
(Offered in 1959-60 and alternate years)
Mr. Nusbaum

PP 604 PLANT PARASITIC NEMATODES **2 (1-3) f**
Prerequisite: 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.
Mrs. Triantaphyllou

PP 605 PLANT VIROLOGY **3 (1-6) f**
Prerequisites: PP 315, GN 411, and a course in organic chemistry
A study of plant viruses including effects on host plants, transmission, classification, methods of purification, determination of properties, chemical nature, structure, and multiplication.
(Offered in 1960-61 and alternate years)
Mr. Hebert

PP 607 (GN 607) GENETICS OF FUNGI **3 (3-0) f**
Prerequisite: GN 512 or equivalent, permission of instructor
Review of major contributions in fungus genetics with emphasis on principles and theories that have evolved in recent developments.
(Offered in 1960-61 and alternate years)
Mr. Nelson

PP 608 HISTORY OF PHYTOPATHOLOGY **1 (1-0)**
Prerequisite: PP 315, permission of instructor
Development of the science of phytopathology from its early beginning to the early part of the 20th century.
(Offered in 1961-62 and alternate years)
Mr. Ellis

PP 611 NEMATODE DISEASES OF PLANTS **3 (1-4) s**
Prerequisite: 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 instructor
Original research in connection with a thesis problem in plant pathology.
Graduate Staff

PP 625 SEMINAR IN PLANT PATHOLOGY **1 (1-0) f s**
Prerequisite: Consent of Seminar Chairman
Discussion of phytopathological topics related 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**
Principles of broiler, market eggs, hatching egg and turkey productions. 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 QUALITY EVALUATIONS **2 (1-3) f**
Prerequisite: PO 201
Elective for others with permission of instructor
Evaluation of poultry for production and standard qualities; determining market, poultry and eggs.
Mr. Brown

PO 351 POULTRY GRADING **1 (0-3) f**
Prerequisite: PO 301
Laboratory experience in determining federal grades of poultry and eggs.
Mr. Brown

PO 401 POULTRY DISEASES **4 (3-3) s**
The major infectious, non-infectious and parasitic diseases of poultry are studied with respect to economic importance, etiology, susceptibility, dissemination, symptoms and lesions. Emphasis is placed upon practices necessary for the prevention, control and treatment of each disease.
Mr. Craig

PO 402 COMMERCIAL POULTRY ENTERPRISES **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**
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 103, 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**
Prerequisite: GN 411
Application of genetic principles to poultry breeding, considering physical traits and physiological characteristics—feather patterns, egg production, hatchability, growth, body conformation and utility.

Mr. Martin

PO 521 POULTRY NUTRITION **3 (2-3) f**
Prerequisites: CH 203, CH 451
Required of majors in Poultry Science
Elective for others with permission of instructor
A study of proteins, carbohydrates, fats, minerals and vitamins required 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 dificiencies in chicks for observation and examination.

Mr. Kelly

PO 522 ENDOCRINOLOGY OF THE FOWL **3 (2-3) s**
Prerequisite: 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, ST 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 611 POULTRY RESEARCH **1-6 (arrange) f s**
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. Credits: A maximum of six is allowed toward a Master's degree.

Graduate Staff

PO 613 SPECIAL PROBLEMS IN POULTRY SCIENCE **1-6 (arrange) f s**
Prerequisite: Graduate standing
Specific problems of study are assigned in various phases of poultry science.

Graduate Staff

PRODUCT DESIGN

PD 201, 202 PRODUCT DESIGN AND ORIENTATION **4 (3-6) f s**
Prerequisite: DN 102
Required of second year students in Product Design
Elementary problems in form and function. Transitional implications of handcrafted and mass-produced objects, in various materials. Demonstrations by specialists in graphics, photography, rendering, modeling, typography, and technical illustration. Visits to design departments of local industries.

Mr. Baron

PD 301, 302 PRODUCT DESIGN **6 (3-12) f s**
Prerequisites: PD 202, PY 212
Required of third year students in Product Design
Manufacturing and structural considerations in the design of a wide range of products.

Mr. Baer

PD 331, 332 MATERIALS AND PROCESSES **3 (3-0) f s**
Required of third year students in Product Design
Study of the basic materials of industry, from raw materials and their properties to fabrication techniques, design criteria and potential.

PD 401, 402 ADVANCED PRODUCT DESIGN **6 (3-12) f s**
Prerequisites: PD 302, PD 332
Continuation of Product Design into more complex systems. Emphasis is placed on functional innovation and integration of form and structure. Thorough analysis of fabrication by models and sketches.

Mr. Macomber

PD 422 OFFICE AND INDUSTRIAL PRACTICE **2 (2-0) s**
Prerequisite: PD 302
Required for graduation in Product Design
Study of the ethics, organization, and procedures of professional product design practice; patent law.

PD 441, 442 DESIGN ANALYSIS **2 (2-0) f s**
Prerequisite: PSY 200
Required of fourth year students in Product Design
Seminar on imaginative problem solving. Individual and group operational techniques in the spectrum of creative thought.

PD 501 ADVANCED PRODUCT DESIGN **8 (3-12) f**
Prerequisite: PD 402
Required of fifth year students in Product Design
Continuation of emphasis on new product design and development, with reference to current developments in automatic fabrication and assembly.

PD 502 PRODUCT DESIGN THESIS **9 (3-18) s**
Prerequisites: PD 501, PD 442, IE series
A one semester project chosen by the student in his area of major interest, with faculty guidance. Independent research and developmnt of functional contribution, including complete programming of manufacture and distribution systems appropriate to the design.

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 s**
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 s**
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 s**
PSY 200 recommended as an introductory course
Applications of psychology to education; problems of learning, motivation, individual differences; 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.
Messrs. Barkley, Drewes, Gray, Miller

COURSES FOR ADVANCED UNDERGRADUATES

PSY 438 INDUSTRIAL PSYCHOLOGY II **3 (3-0) s**
Prerequisites: PSY 200, PSY 337
The application of psychological principles to the problems of modern industry; with particular emphasis on human relations and supervision.
Mr. Miller

PSY 441 HUMAN FACTORS IN EQUIPMENT DESIGN **3 (3-0) s**
Prerequisite: PSY 200
Human factors in the design of machines and other equipment. Items of equipment are understood as extensions of man's capacity to sense, comprehend, and control his environment. Includes problems in the psychology of information, communication, control, and invention.
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 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 preceive visual form.
Mr. Cook

PSY 475 CHILD PSYCHOLOGY **3 (3-0)**
Prerequisite: PSY 200 or PSY 304 **Summer session only**
The development of the individual child of the elementary school age will be the inclusive object 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) f s**
Prerequisite: PSY 200 or PSY 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 ADVANCED UNDERGRADUATES AND GRADUATES

PSY 501 INTERMEDIATE EXPERIMENTAL PSYCHOLOGY **3 (2-3) f s**
Prerequisites: 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, Cook, Newman

PSY 502 PHYSIOLOGICAL PSYCHOLOGY **3 (3-0) f**
Prerequisites: 12 hours of Psychology, including PSY 200, PSY 201
A survey of the physiological bases of behavior including the study of coordination, sensory processes, brain functions, emotiona, and motivation.
Mr. Corter

PSY 504 ADVANCED EDUCATIONAL PSYCHOLOGY **3 (3-0) s**
Prerequisite: Six hours in Psychology
An advanced course giving a critical appraisal and a consideration of the practical applications for education of modern psychological findings.
Messrs. Johnson, Newman

PSY 511 ADVANCED SOCIAL PSYCHOLOGY **3 (3-0) f**
Prerequisites: PSY 200 and three additional hours in Psychology
A study of social relationships and their psychological bases; emphasis on those aspects of behavior determined by personal interactions; work will involve analysis of representative research studies, and individual projects.
Mr. Miller

PSY 514 CURRENT PROBLEMS IN PSYCHOLOGY **1 (1-0) f**
Prerequisite: Graduate standing in Psychology
A study of current developments in theory and research in several areas of psychological interests.
Graduate Staff

PSY 530 ABNORMAL PSYCHOLOGY **3 (3-0) s**
Prerequisites: PSY 200, PSY 302
A study of the causes, symptomatic behavior, and treatment of the major personality disturbances, emphasis also placed on preventive mental hygiene methods.
Mr. Corter

PSY 535 TESTS AND MEASUREMENTS **3 (3-0) f s**
Prerequisite: Six hours in Psychology
A study of psychological 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.
Mr. Johnson

PSY 550 MENTAL HYGIENE IN TEACHING **3 (3-0) f**
Prerequisite: Six 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 565 INDUSTRIAL MANAGEMENT PSYCHOLOGY **3 (3-0) f 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 psychological approaches to industrial problems in industrial management.
Mr. Miller

PSY 570 INTELLIGENCE AND PERSONALITY: THEORY AND MEASUREMENT I **3 (3-0) f**
Prerequisites PSY 200 and three additional hours in Psychology
An introduction to individual personality and intelligence testing, theoretical background of intelligence and personality.
Mr. Corter

PSY 571 INTELLIGENCE AND PERSONALITY: THEORY AND MEASUREMENT II **3 (3-0) s**
Prerequisite: PSY 570
A practicum in individual intelligence testing with emphasis on the Wechsler-Bellevue, Stanford-Binet, report writing, and case studies.
Mr. Corter

PSY 576 DEVELOPMENTAL PSYCHOLOGY **3 (3-0) s**
Prerequisite: Nine hours in Psychology, including PSY 476 or PSY 475
A survey of the role of growth and development in human behavior; particularly at the child and adolescent periods. This course will pay particular attention to basic principles and theories in the area of developmental psychology.
Mr. Johnson

PSY 578 INDIVIDUAL DIFFERENCES **3 (3-0) f**
Prerequisite: Six hours in Psychology
Nature, extent, and practical implications of individual differences and individual variation.
Mr. Barkley

COURSES FOR GRADUATES ONLY

PSY 604 EXPERIMENTAL PSYCHOLOGY **3 (2-3) f or s**
Prerequisite: PSY 501
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 field of applied psychology.
Messrs. Barkley, Cook, Newman

PSY 606 BEHAVIOR THEORY **3 (3-0) s**
Prerequisites: PSY 200, a course in learning, Experimental Psychology and Statistics.
A study of the most fundamental considerations in behavior theory. Such topics as criteria of scientific meaningfulness, the nature of scientific explanation, the application of formal, logical techniques to theory analysis, the nature of probability, operationism, intervening variables, etc., will be covered. The aim of the course is to develop skill in handling theoretical concepts, the ability to analyze and evaluate theories, to deduce hypotheses from them, and to devise means of testing them.

Mr. Cook

PSY 607 ADVANCED INDUSTRIAL PSYCHOLOGY I **3 (3-0) f**
Prerequisites: One undergraduate course beyond General Psychology in Applied or Experimental Psychology.
Application of scientific methods to the measurement and understanding of industrial behavior.

Messrs. Drewes, Gray, Miller

PSY 608 ADVANCED INDUSTRIAL PSYCHOLOGY II **3 (3-0) s**
Prerequisites: One undergraduate course beyond General Psychology in Applied or Experimental Psychology.
Practical applications of the methods of industrial psychology.

Messrs. Drewes, Gray, Miller

PSY 609 PSYCHOLOGICAL CLINIC PRACTICUM **Maximum 3 hours f s**
Prerequisite: Eight hours in Psychology
Clinical participation in interviewing, counseling, psychotherapy and administraton of psychological tests. Practicum to be concerned with adults and children.

Mr. Corter

PSY 610 THEORIES OF LEARNING **3 (3-0) s**
Prerequisite: Eight hours in Psychology
A study of theories of learning with emphasis upon applications of the principles of learning.

Messrs. Barkley, Johnson, Newman

PSY 612 SEMINAR IN INDUSTRIAL PSYCHOLOGY **3 (3-0) f s**
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**
Individual or group research problems; a maximum of six credits is allowed toward the Master's degree.

Graduate Staff

PSY 635 PSYCHOLOGICAL MEASUREMENT **3 (3-0) s**
Prerequisite: Stat 511 or equivalent
Theory of psychological measurement. Statistical problems and techniques in test construction.

Mr. Gray

PSY 672 INTELLIGENCE AND PERSONALITY: THEORY AND MEASUREMENT III **3 (2-3)**
Prerequisites: PSY 570, PSY 571 Summer session only.
Theory and practicum in individual personality testing of children and adults with emphasis on projective techniques, other personality measures, report writing and case studies.

Mr. Corter

RECREATION AND PARK ADMINISTRATION

COURSES FOR UNDERGRADUATES

REC 152 INTRODUCTION TO RECREATION **3 (3-0) 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. Hines

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.

Mr. Stott

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

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 (3-0) 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 creative and combined activites. Outside studies and assigned readings with reports are required.

Mr. Crawford, Visiting Instructors

REC 253 PRINCIPLES OF PHYSICAL EDUCATION **3 (3-0) 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 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 the 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 (2-2) 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 UNDERGRADUATES

REC 401 PRINCIPLES AND PRACTICES OF INDUSTRIAL RECREATION **2(2-0) s**
A study of existing programs of industrial recreation, their recreation, methods of finance, scope and problems is emphasized. Relationship of industrial recreaton 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

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. Miller

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 opreation 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. Miller

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

REC 501 SPECIAL PROBLEMS IN RECREATION **3 (2-2) f**
Prerequisites: Completion of 20 hours credit in recreation courses or equivalent and 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

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 **3 (3-0) 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 prevention.
Mr. Mayo

RS 442 RURAL SOCIAL STRUCTURE **3 (3-0) s**
Prerequisite: RS 301 or permission of 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

* Additional courses, suitable for rural sociology majors and graduates students, are listed in the offerings of the Department of Sociology and Anthropology. 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 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 SOCIOLOGICAL ANALYSIS OF AGRICULTURAL LAND TENURE SYSTEMS **3 (3-0) f**
Prerequisite: Permission of the instructor
A systematic sociological analysis of the major agricutural 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) FARMERS' 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, co-operative 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 stimulating 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

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 instructor
The rural community is viewed in sociological perspective as a functional 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**
Prerequisite: 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 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

COURSES FOR UNDERGRADUATES

SOC 202 PRINCIPLES OF 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, publics, social movements.

SOC 302 PUBLIC RELATIONS AND MODERN SOCIETY **3 (3-0) f s**
The development and composition of social groups and the processes involved in group organization. These are analyzed in terms of the expanding functions of mass communication in contemporary society.

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**
The social organization of the family with special attention to socialization, marital choice, kinship relations, and the social changes affecting 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 CRIMINOLOGY **3 (3-0) f s**
The study of causation, treatment, prevention, and control of criminality and juvenile delinquency. Special emphasis is placed on socio-cultural theories of causation and on the examination of court and correctional systems for adults and juveniles. Arranged field trips.

SOC 401 HUMAN RELATIONS IN INDUSTRIAL SOCIETY **3 (3-0) f s**
Studies in the sociology of occupations, professions, and work with special attention to human relations in industrial plants and other work situations.

SOC 402 URBAN SOCIOLOGY **3 (3-0) f s**
A study of the factors in the growth of cities; the relationship bewteen the design of cities and their social organization; detailed analysis of new developments in the serving of human needs. City and regional planning.

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.

SOC 414 SOCIAL STRUCTURE **3 (3-0) f s**
Studies of the major social institutions and systems of stratification; the organization of social systems as, for example, religion, education, and government; the functions of such structural components as age and sex groups, vocational and professional groups, and social classes.

SOC 416 RESEARCH METHODS **3 (3-0) f s**
An analysis of the principle methods of social research; the development of experiments; schedules and questionnaires; the measurement of behavior.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

SOC 501 LEADERSHIP **3 (3-0) f s**
Prerequisites: SOC 202, SOC 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, scientfic and executive leadership problems.

SOC 502 SOCIETY, CULTURE, AND PERSONALITY **3 (3-0) f s**
Prerequisites: SOC 202, SOC 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.

SOC 505 THE SOCIOLOGY OF REHABILITATION **3 (3-0) f s**
Prerequisites: SOC 202, SOC 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.

SOC 510 INDUSTRIAL SOCIOLOGY **3 (3-0) f s**
Prerequisites: SOC 202, SOC 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.

SOC 511 SOCIAL THEORY **3 (3-0) f s**
Prerequisites: Nine semester hours of sociology, or equivalent work in related fields, and permission of instructor.
The study of social theories from the earliest recorded thinkers to those of modern times; the evolution of theories of the individual, groups, culture, community, and society; the modern development of sociology and anthropology, and interpretive systems accompanying these developments.

SOC 515 RESEARCH IN APPLIED SOCIOLOGY **3 (3-0) f s**
Prerequisites: SOC 202, SOC 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.

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. Younts

SOI 302 SOILS AND PLANT GROWTH **3 (3-0) s**
Prerequisites: SOI 200, BO 103, 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. Hunter

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**
Prerequisites: SOI 200, BO 103
History of plant nutrition and soil fertiltiy. 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. Younts

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.
Staff

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 soil 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, CH 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.
(Offered in 1961-62 and in alternate years)

Mr. Weed

SOI 522 SOIL CHEMISTRY (Biochemical) **4 (3-1) s**
Prerequisites: SOI 341, CH 212, CH 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.
(Offered in 1961-62 and in alternate years)

Mr. Volk

SOI 532 SOIL MICROBIOLOGY **3 (3-0) f**
Prerequisites: SOI 200, BO 412, BO 421
The more important microbiological processes that occur in soils; decomposition of organic materials, ammonification, nitrification, and nitrogen fixation.
(Offered in 1960-61 and in alternate years)

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.
(Offered in 1960-61 and in alternate years)

Mr. McCracken

SOI 570 SPECIAL PROBLEMS **Credits by arrangements**
Prerequisites: 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

(Students are expected to consult instructor before registration)

SOI 611 ADVANCED SOIL PHYSICS **4 (arranged)**
Prerequisites: SOI 511, MA 301, 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.
(Offered in 1961-62 and in alternate years)

Mr. Van Bavel

SOI 622 ADVANCED SOIL CHEMISTRY **2-4 by arrangement**
Prerequisites: SOI 521, SOI 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.
(Offered in 1960-61 and in alternate years)

Mr. Coleman

SOI 632 ADVANCED SOIL MICROBIOLOGY **2-4 as arranged**
Prerequisites: SOI 522, SOI 531, CH 421, CH 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) Plant-microbial relationships.
(Offered in 1961-62 and in alternate years)

Mr. Bartholomew

SOI 642 ADVANCED SOIL FERTILITY **3 (3-0) s**
Prerequisites: SOI 511, SOI 521, SOI 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.
(Offered in 1961-62 and in alternate years)

Mr. Fitts

SOI 651 ADVANCED SOIL GENESIS AND CLASSIFICATION **2-3, by arrangement f or s**
Prerequisites: SOI 521, SOI 551
A critical study of current theories and concepts in soil genesis and morphology; detailed 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, structure of soil classification schemes. Any of these topics may be emphasized at the expense of the others according to interests of students.
(Offered in 1961-62 and in alternate years)

Mr. McCracken

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

STATISTICS

SEE EXPERIMENTAL STATISTICS

TEXTILES

COURSES FOR UNDERGRADUATES

Textile Technology

TX 181 INTRODUCTION TO TEXTILES **1 (1-0) f s**
Required of freshmen in all Textlie curricula
A general introduction to the scope, products, organizations, and activities of the textile industry.
One 1-hour lecture period per week

Messrs. Dunlap, Klibbe

TX 261 FABRIC STRUCTURE **3 (2-2) f s**
Prerequisite: TX 283
Required of students in all Textile curricula
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 period per week

Messrs. Berry, Klibbe

TX 271 UPHOLSTERY FABRICS **2 (2-0) s**
Required of students 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 lecture periods per week
Mr. Whittier

TX 281 FIBER QUALITY **3 (2-2) f s**
Prerequisite: TX 283
Required of students in all Textile curricula
A study of the physical, chemical and aesthetic properties of the major textile fibers. Included are methods of measuring fiber properties and interpretation of test results, complete analysis of typical stress-strain curves, influence of moisture on physical properties, and fiber identification.
Two 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Hamby, Wiggins

TX 283 FUNDAMENTALS OF TEXTILES **2 (1-2) f s**
Prerequisite: MA 101 or MA 111, or equivalent
Required of students in all Textile curricula
Nomenclature, flow of processes through weaving, yarn numbering systems, basic calculations of machinery constants, textile production, and yarn and fabric structures. One 1-hour lecture and one 2-hour laboratory period per week.
Messrs. Klibbe, Lassiter, Moser

TX 303 FIBER AND YARN TECHNOLOGY **4 (3-2) f s**
Prerequisite: TX 281
Required of all students in the Textile Technology curriculum.
Technological and scientific concepts of fiber and yarn structures and modifications resulting from processing. For all systems, the opening, cleaning and carding actions; blending of fibers stressing intimacy, methods, effectiveness, and influence on product; yarn structure as a factor of blend, fiber distribution, twist in its many ramifications, spinning limits; composite yarn structures; bulk and yarn coverage; drafting methods, types, and limits.
Three 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Hamby, Pardue, Lassiter

TX 304 FIBER AND YARN TECHNOLOGY **4 (3-2) f s**
Prerequisite: TX 303
Required of students in Fiber and Yarn Technology and General Textiles
Elective for others.
Technological and economic aspects of fiber and yarn processing including: packaging, production and efficiency levels; specialized yarn processes such as combing with economic justifications; design and use of specialty novelty yarns; economical and mechanical limitations of textile equipment.
Three 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Stuckey, Pardue, Hamby

TX 327 TEXTILE TESTING **4 (3-2) f s**
Prerequisites: TX 303, TX 365, ST 361
Required of students in all Textile curricula
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. Three 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Hamby, Stuckey; Mrs. Guin

TX 365 FABRIC TECHNOLOGY **4 (3-2) f s**
Prerequisites: TX 261; TX 281
Required of students in the Textile Technology curriculum
Geometry of fabrics; properties of fabrics dependent on the weave, geometrical configurations and yarn properties, such as compressional resilience, air and water permeability, water repellency, creasing tendencies, abrasion properties, hand, and drape. Mechanical properties of fabrics; transmission of heat, moisture, and air. Yarn additives and treatments; slashing and warp preparation, materials, and techniques. Non-woven structures.
Three 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Whittier, Porter

TX 366 FABRIC TECHNOLOGY **4 (3-2) f s**
Prerequisite: TX 365
Required of students in Fabric Technology and General Textiles
Elective for others.
Technology and economic aspects of fabric construction, design, and production. The classical weaves, their design, inherent uses, production techniques, and types of looms required. Marketing methods, with Worth Street and other trade rules and regulations. The loom as a production unit: types, nomenclature, basic and special mechanisms. Mill balance. Fabric defects. Three 1-hour lectures and one 2-hour laboratory period per week.
Messrs. Moser, Berry

TX 430 CONTINUOUS FILAMENT YARNS **3 (2-2) f s**
Prerequisite: TX 303
Required of Students in Fiber and Yarn Technology and Knitting Technology.
Elective for others.
A study of properties and processes applicable only to filament yarns such as texturizing and bulking. Detailed studies of throwing systems, engineering requirements of equipment, and yarn property changes resulting from processing. Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Wiggins

TX 436 STAPLE FIBER PROCESSING **3 (2-2) f s**
Prerequisite: TX 303
Required of students in Fiber and Yarn Technology
Elective for others.
A study of special systems of processing long staple, natural and man-made fibers, including woolen, worsted, direct spinning, Turbo Stapler, or Pacific Converter, and sliver to yarn methods. New concepts and research findings as applied to all yarn processes. Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Pardue

TX 478 DESIGN AND WEAVING **3 (2-2) f s**
Prerequisite: TX 366
Required of students in Fabric Technology
Elective for others
Advanced study of special weave formations and the techniques and equipment necessary to form these fabrics. Studies in depth of new developments and research findings in the areas of warp preparation, design, weaving, and fabric formation. Two 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Porter, Berry

TX 485 MILL DESIGN AND ORGANIZATION **3 (2-2) s**
Prerequisites: TX 303; TX 365
Required of students in the Textile Technology curriculum
Application of economic principles of textile factoring, hedging, and other buying and selling problems. Inventory control, organization, and departmental functions of textile companies. Technical problems of plant site selection, plant design and layout, and selection of equipment. Layout of a mill by each student. Two 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Grover, Pardue

TX 490 DEVELOPMENT PROJECT I **1 (0-2) f s**
Prerequisite: Senior standing and permission of instructor
Elective
A problem of independent study assigned to seniors in the major field of study serving also as the laboratory period for senior level courses. One 2-hour laboratory period per week.

Staff

Knitting Technology

TX 342 KNITTING PRINCIPLES **2 (2-0) f s**
Prerequisite: TX 281 and TX 283
Required of juniors in Textile Technology and Knitting Technology. A basic course in knitted fabric construction with emphasis on the many types of stitch structures found in knitted textiles. Attention is also devoted to the equipment and mechanisms necessary to produce these structures. Two 1-hour lecture periods per week.

Messrs. Lewis, Middleton, Shinn

TX 441 FLAT KNITTING **3 (2-2) f**
Prerequisite: TX 342
Required of seniors in Knitting Technology
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 442 KNITTED FABRICS **3 (2-2) f s**
Prerequisite: TX 342
Required of seniors in Textile Technology and Knitting Technology
Design, analysis, and production of knitted fabrics, including flat, circular, and warp types. The economic aspects of the knitting process as a method of clothing production. Introduction to garment design, production and marketing. Two 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Shinn, Middleton

TX 444 GARMENT MANUFACTURE **3 (2-2) s**
Prerequisite: TX 342
Required of seniors in Knitting Technology
Elective for others
A study of circular latch needle and spring needle machines for knitted 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.

Mr. Shinn

TX 445 FULL-FASHIONED HOSIERY MANUFACTURE **2 (2-0) s**
Prerequisite: TX 342
Offered by election
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. Two 1-hour lectures per week.

Mr. Lewis

TX 447, 448 ADVANCED KNITTING LABORATORY **2 (0-4) f s**
Prerequisite: TX 342
Required of seniors in Knitting Technology
Elective for others
Systematic study of circular hosiery mechanisms; hosiery types and constructions. Seamless hosiery production methods utilizing the newer synthetic yarns, toe closing methods, finishing processes, and marketing are emphasized.

Mr. Lewis

TX 449 TRICOT KNITTING **3 (2-2) s**
Prerequisite: TX 342
Elective for juniors and seniors
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

TX 483 TEXTILE COST METHODS **2 (2-0) f s**
Prerequisites: TX 303, TX 365
Required of seniors in Textile Technology except those in Management
A study 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

Textile Chemistry

TC 201 TEXTILE CHEMISTRY I **2 (2-0) f s**
Prerequisite: CH 103
Required of Sophomores in Textile Technology
A comprehensive course designed to familiarize the student with the chemical properties of all natural and synthetic fibers, and within 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. Two 1-hour lectures per week.

Mr. Rutherford

TC 303, 304 TEXTILE CHEMISTRY III **3 (2-3) f s**
Corequisites: CH 421; CH 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 3-hour laboratory period per week.

Mr. Hayes

TC 307 TEXTILE CHEMISTRY II **4 (3-2) f**
Prerequisites: TC 201; TX 281
Required of seniors in Textile Technology
A comprehensive course covering scouring, bleaching, and dyeing of textile materials. Also fabric finishing, effects of heat and chemicals on fibers, and the economic aspects of different dyes and chemical treatments on fibers and fabrics. Three 1-hour lectures and one 2-hour laboratory period per week.

Mr. Hayes

TC 403, 404 TEXTILE CHEMICAL TECHNOLOGY **5 (3-6) f s**
Prerequisite: TC 304; CH 422
Required of seniors in Textile Chemistry
Basic principles are applied to the study of three important areas of textile processing: dyeing, printing, and finishing. These areas are concerned with the chemical nature of dyes and other chemical agents applied to fibrous systems; with the chemical and physical properties of the various fibers; and with the mechanical aspects of the application of chemical materials to fibers and fabrics. The course includes: an extensive review of the various classes of dyes and their application to all important textile fibers and blends of fibers; a comparative analysis of dyeing machinery and processes involving special machinery and equipment; a survey of modern preparatory and bleaching for all important fibers; a study of the roller printing machine, and the principles involved in print formulations for the major classes of dyes and their application to the various fibers; a study of important mechanical, additive, and chemical modification type finishes for fabric. Three 1-hour lectures and two 3-hour laboratories per week.
Mr. Campbell

TC 411 TEXTILE CHEMICAL ANALYSIS I **3 (1-6) f s**
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 two 3-hour laboratory periods per week.
Messrs. Campbell, Rutherford

TC 412 TEXTILE CHEMICAL ANALYSIS II **3 (1-6) f s**
Prerequisites: CH 211, 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 3-hour laboratory periods per week.
Messrs. Campbell, Rutherford

TC 421 FABRIC FINISHING I **2 (2-0) f s**
Prerequisite: TC 201
Elective for students in Textile Technology
Students in Textile Chemistry may not take this course for degree credit
A general course in fabric finishing designed for students not majoring in Textile Chemistry. Emphasis placed on finishes used on garment-type fabrics, includng 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

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

Textile Technology

TX 501 YARN TECHNOLOGY SEMINAR **2 (2-0) s**
Prerequisite: Senior standing and permission of instructor
Elective
Lecture and discussion periods are designed for students who are particularly interested in yarn manufacturing aspects of the textile industry. Subject matter will include such 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 TEXTILE TESTING II **3 (2-3) f**
Prerequisite: TX 327
Elective
Advanced techniques for measuring properties of natural and man-made fibers, yarns, and fabrics. Interrelations of raw material, quality, processing characteristics, and end product properties. The application of the laws of physical sciences to evaluation of textile materials. Two 1-hour lectures and one 3-hour laboratory per week.
Messrs. Hamby, Stuckey

TX 522 TEXTILE QUALITY CONTROL **3 (2-3) s**
Prerequisite: TX 521
Elective
Quality control systems for textile operations. Defect prevention methods, isolation of processes contributing to substandard quality, relationship between quality control department and operating divisions. Laboratory design, equipment and personnel selection, installation of quality control systems. Two 1-hour lectures and one 3-hour laboratory period per week.
Messrs. Hamby, Stuckey

TX 524 SPECIAL PROJECTS IN TEXTILES **1 to 3 f s**
Prerequisite: TX 327; Senior standing, permission of instructors
Elective
Special studies in either the major or minor field of the advanced undergraduate or graduate student. These special studies will take the form of current problems of the industry, independent investigations in the areas of textile testing and quality control, seminars and technical presentations, both oral and written.
Staff

TX 525 ADVANCED TEXTILE MICROSCOPY **2 (arranged) f s**
Prerequisite: TX 327
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 laboratory arranged.
Mr. Stuckey

TX 551 COMPLEX WOVEN TEXTILE STRUCTURES **2 (2-0) s**
Prerequisite: TX 366
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 366
Elective
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 366
Elective
The application of punched card techniques to the design and manufacture of certain fabrics having intricate decorative patterns and special surface characteristics. Two 1-hour lectures and one 2-hour laboratory period per week.
Mr. Berry

TX 575 FABRIC ANALYTICS AND CHARACTERISTICS **3 (3-0) f s**
Required of students in Fabric Technology
Prerequisite: TX 365 or TX 366 or TC 511
Elective for others
Correlation of fiber and yarn properties with those of the fabric. Fabric design features related to utilitarian as well as aesthetic values, with case studies of successful fabrics. Inspection and classification of defects with economic aspects. Engineering design of fabrics utilizing blends of fibers and yarns. Three 1-hour lectures per week.
Mr. Whittier

General Textile Course

TX 581 INSTRUMENTATION AND CONTROL **3 (2-2) f s**
Prerequisite: PY 212
Required of all seniors in all Textile Curricula
A lecture series with coordinated laboratory exercises designed to familiarize the student with the theory and application of instruments and control apparatus found 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

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 CHEMISTRY OF FIBERS **3 (3-0) f**
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. Three 1-hour lectures per week.

Mr. Rutherford

TC 512 (CH 512) CHEMISTRY OF HIGH POLYMERS **3 (3-0) f s**
Prerequisite: CH 341 or CH 531
Elective for Textitle Chemistry students
Mechanisms and Kinetics of polymerization; molecular weight description; theory of polymer solutions. Three 1-hour lectures per week.

Mr. Cates

TC 521 TEXTILE CHEMICAL ANALYSIS III **3 (arranged) f s**
Prerequisite: TC 421 or permission of instructor
Elective for all Textile Technology 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.

Graduate Staff

COURSES FOR GRADUATES ONLY

TX 601, 602 YARN TECHNOLOGY **3 (arranged) f s**
This course provides the student with an opportunity for intensive study of advanced topics in the field of yarn technology.

Messrs. Grover, Hamby

TX 621 TEXTILE TESTING III **2 (1-2) f s**
Prerequisite: TX 522
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. One 1-hour lecture and one 2-hour laboratory period per week.

Mr. Hamby

TX 631 SYNTHETIC FIBERS **2 (arranged) s**
Prerequisite: TX 430 or TX 436 or equivalent
Lectures and projects on advanced problems relative to the properties and processing of man-made continuous filament and staple fiber yarns.

Messrs. Grover, Hamby

TX 641, 642 ADVANCED KNITTING SYSTEMS AND MECHANISMS **3 (arranged) 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 which covers important developments in the hosiery industry. Three 1-hour lectures per week.

Mr. Shinn

TX 643, 644 KNITTING TECHNOLOGY **3 (2-2) f s**
Prerequisites: Graduate standing and 8 credits in Knitting Technology
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 (arranged) f s**
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 SEMINAR **1 (1-0) f s**
Discussion of current scientific publications of interest to the textile industry; review and discussion of student papers and research problems.
Graduate Staff

TC 605 PHYSICAL CHEMISTRY OF DYEING **3 (arranged) f s**
Prerequisite: CH 342
Development of principles of thermodynamics, emphasizing applications in dye and fiber chemistry.
Mr. Cates

TC 606 CHEMISTRY OF FIBER-FORMING HIGH POLYMERS **3 (arranged) f s**
Prerequisite: CH 341 or CH 531
Composition and structure of high polymers; properties of linear polymers with particular emphasis on mechanical behavior; chemistry of high polymer degradation. Three 1-hour lectures per week.
Mr. Cates

ZOOLOGY

COURSES FOR UNDERGRADUATES

ZO 103 GENERAL ZOOLOGY **4 (3-2) f s**
The study of animals with special reference to the morphology, physiology, and ecology of those forms that illustrate zoological principles.
Staff

ZO 205 INVERTEBRATE ZOOLOGY **4 (3-3) f**
Prerequisite: ZO 103
The biology and classification of the invertebrate animals with special reference to the forms commonly encountered and those which illustrate zoological principles.
Mr. Miller

ZO 206 VERTEBRATE ZOOLOGY **4 (3-3) s**
Prerequisite: ZO 103 or equivalent
A study of the fishes, amphibians, reptiles, birds, and mammals, chiefly of North Carolina, their identification, systematics, life histories, observational methods used in the study of their behavior, and habitat relations.
Mr. Hester

ZO 212 HUMAN ANATOMY **3 (2-2) f**
Prerequisite: ZO 103
A study of human anatomy with major emphasis on the structure and function of the musclar, skeletal, circulatory and nervous systems. Required of majors in recreation.
Mr. Miller

ZO 213 HUMAN PHYSIOLOGY **3 (3-0) s**
Prerequisite: ZO 103
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 s**
Prerequisite: ZO 103
A comparative morphology of vertebrates demonstrating the interrelationships of the organ systems of the various groups.
Mr. Harkema

ZO 301 ANIMAL PHYSIOLOGY **3 (2-3) f s**
Prerequisites: ZO 103, PY 211, CH 101, or CH 201, and CH 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 103, 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) f**
Prerequisite: ZO 103
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 RESOURCES CONSERVATION **3 (3-0) f**
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 under-lie their conservation and the impact of over-exploitation on primitive and civilized societies. Emphasis is placed on the renewable resources, particularly wildlife.

Mr. Barkalow

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ZO 452 ANIMAL MICROTECHNIQUE **3 (1-5) s**
Prerequisites: ZO 103, CH 203
The theory and practice of preparing temporary and permanent histological mounts for microscopic study.

Mr. Harkema

ZO 501 ORNITHOLOGY **3 (2-3) s**
Prerequisite: ZO 103
The biology and classifications of birds. Field trips for the study and identification of local forms, including trips to Lake Mattamuskeet in February and the coast in May. Individual research projects on nesting populations.

Mr. Quay

ZO 513 ADVANCED ANIMAL PHYSIOLOGY I **3 (3-0) f**
Prerequisite: ZO 301
The comparative physiology of selected systems. Topics will be chosen for detailed consideration in lectures, collateral reading, and class discussion. Each student will, in addition, prepare a term report. A few topics for study may 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

ZO 520 FISHERY SCIENCE **3 (1-6) f**
Prerequisite: ZO 103, approval of the instructor
This course is intended as an introduction to the principles and methods of fishery science. Current theories and practices of fish management will be studied. Life history and biology of important game and commercial species. Survey of fishery resources.

Mr. Hassler

ZO 521 FISHERY SCIENCE **3 (1-6) s**
Prerequisites: ZO 520, ST 311, approval of the instructor
An analysis of fishery research methods and objectives. Detailed studies of the procedures for estimating fish populations, annual reproduction, mortality rates, growth rates, and exploitation rates. The relationship between natural fluctuations in fisheries and environmental factors.

Mr. Hassler

ZO 522 ANIMAL ECOLOGY **3 (3-0) s**
Prerequisites: ZO 103, BO 103
The interrelations of animals and their environments—land, fresh water, marine.

Mr. Quay

ZO 532 (GN 532) BIOLOGICAL EFFECTS OF RADIATIONS **3 (3-0) s**
Prerequisite: ZO 103, approval of the instructor
Recommended Correlatives: GN 411, ZO 301, 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**
Prerequisite: ZO 103
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. Hassler

ZO 542 COLD-BLOODED VERTEBRATES (HERPETOLOGY) **3 (1-4) f**
Prerequisite: ZO 103
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. Hassler

ZO 544 MAMMALOGY **3 (1-4) f**
Prerequisites: ZO 103, ZO 223, approval of the instructor
The classification, identification, and ecology of the major groups of mammals.

Mr. Barkalow

ZO 545 HISTOLOGY **4 (2-4) f**
Prerequisite: ZO 103
The microscopic anatomy of animal tissues.

Mr. Roberts

ZO 551, 552 WILDLIFE SCIENCE **3 (2-3) f s**
Prerequisite: ZO 206
The principles of wildlife management and their application are studied in the field and laboratory. Designed primarily for seniors majoring in Wildlife Biology.

Mr. Barkalow

ZO 561 ANIMAL EMBRYOLOGY **4 (2-4) f**
Prerequisite: ZO 103
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. Alliston

ZO 571 SPECIAL STUDIES **Credits by arrangement**
Prerequisites: ZO 103, approval of the instructor
A directed individual investigation of a particular problem in Zoology, accompanied by a review of the pertinent literature. A maximum of three credits allowed toward the bachelor's degree, six toward the master's degree, and nine toward the doctorate.

Graduate Staff

ZO 591 PARASITOLOGY I **4 (2-4) s**
Prerequisites: ZO 103, 223
The study of the morphology and control of the parasitic protozoa and helminths of man, domestic and wild animals.
(Offered in Fall 1961)

Mr. Harkema

ZO 592 (ENT 582) PARASITOLOGY II (MEDICAL ENTOMOLOGY) **3 (2-3) s**
Prerequisite: ENT 301 or 312
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 614 ADVANCED ANIMAL PHYSIOLOGY II **3 (3-0) s**
Prerequisites: ZO 301, 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

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**
Prerequisites: ZO 522, 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, 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

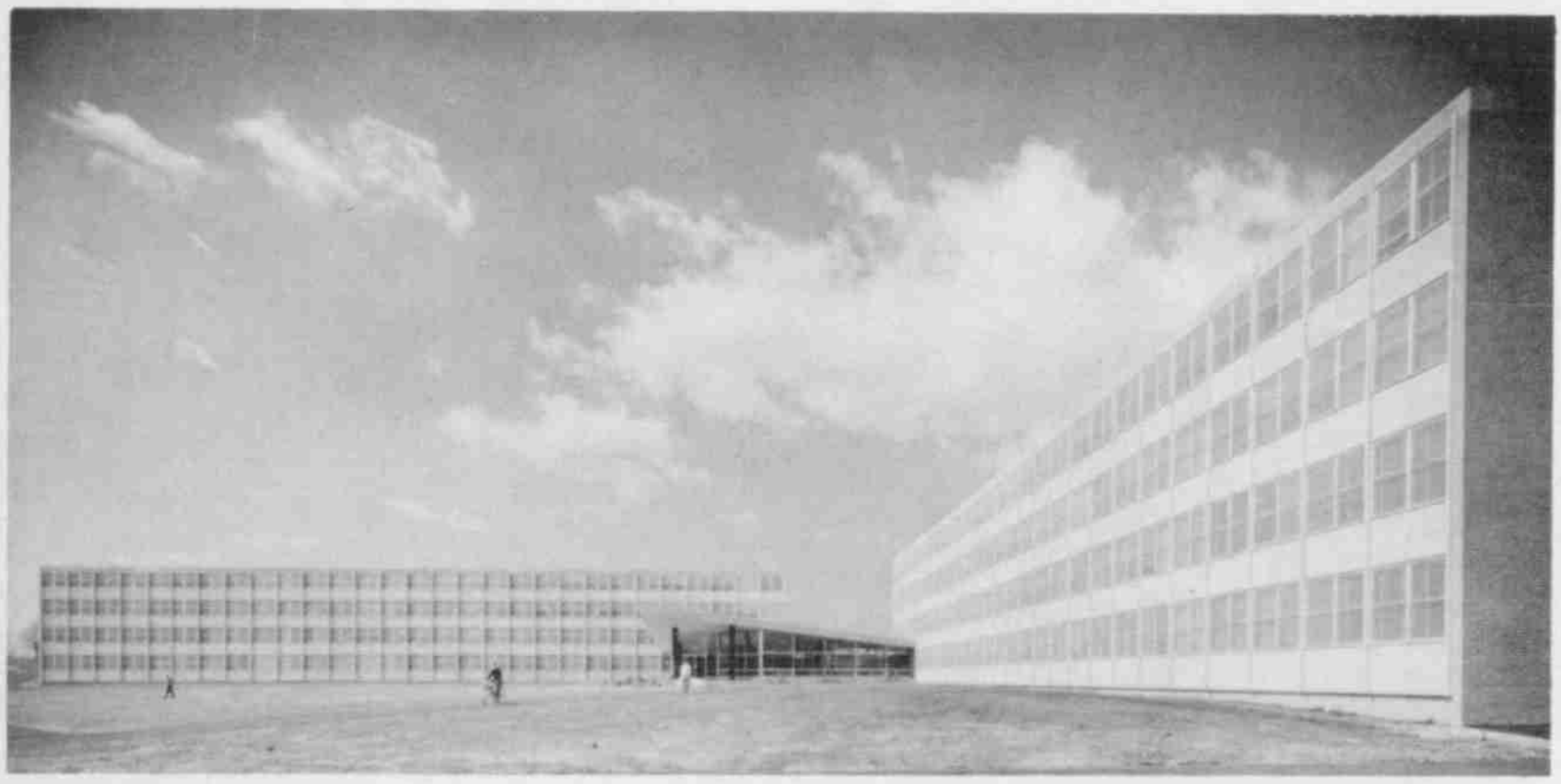
Engineering and Textile Buildings

RIDDICK Engineering Laboratories Building is the home of the administrative offices of the School of Engineering and the Departments of Chemical Engineering, Industrial Engineering, Engineering Mechanics, and Engineering Research, and Riddick Auditorium. The building is named for the late Dr. W. C. Riddick, a former president of State College.

NELSON Textile Building houses the School of Textiles and is located on the campus facing Hillsboro Street. The building is named for the late Dr. Thomas E. Nelson, the first dean of the School of Textiles.

Administration and Faculty

New Look On Campus . . .



ULTRA-MODERN Bragaw Dormitory opened its doors to students in September 1958. Featuring the latest in architectural design, the dormitory houses more than 800 students and was built at a cost of $2,000,000.

HARRELSON HALL (model above), now under construction, offers a new approach to classroom design. The building will be outstandingly different because it is round. The classroom will accommodate up to 4,500 students at one time and its cost will be 2¼ million dollars.

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 in order 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.

The 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 (now known as the Alumni Memorial 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 assist 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 Decmeber 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., was 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. 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 except for July and August 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 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

The enrollment at North Carolina State College for the 1960 fall semester totaled 6,510 students, 6,324 men and 186 women.

Enrollment By Classification

Freshmen	1810
Sophomores	1171
Juniors	1113
Seniors	1318
5th Year Professionals	20
Graduates	755
Unclassified	204
Agricultural Institute	94
Special and Auditors	25
	6510

Enrollment By Schools

Agriculture	766
Design	300
Education	640
Engineering	3277
Forestry	417
Physical Sciences and Applied Mathematics	414
Textiles	429
General Studies (Auditors and Unclassified)	133
Graduate (Unclassified)	40
Agricultural Institute	94
	6510

TRUSTEES

THE CONSOLIDATED UNIVERSITY OF NORTH CAROLINA

The University of North Carolina at Chapel Hill
North Carolina State College of Agriculture and Engineering at Raleigh
The Woman's College at Greensboro

BOARD OF TRUSTEES

Terry Sanford, *Governor, chairman, ex-officio, Raleigh*
Charles F. Carroll, *Superintendent of Public Instruction, member ex-officio, Raleigh*
Arch T. Allen, *secretary of the Board, Raleigh*
Miss Billie Curtis, *assistant secretary, Chapel Hill*

TERM EXPIRES 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. Roy B. McKnight	*Charlotte*	*Mecklenburg*
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. C. W. Tillett	*Charlotte*	*Mecklenburg*
Carl V. Venters	*Jacksonville*	*Onslow*
J. Shelton Wicker	*Sanford*	*Lee*

TERM EXPIRES APRIL 1, 1963

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 McIver 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 EXPIRES APRIL 1, 1965

Dr. Francis A. Buchanan	*Hendersonville*	*Henderson*
Dr. Jesse B. Caldwell	*Gastonia*	*Gaston*
Lenox G. Cooper	*Wilmington*	*New Hanover*
Marshall Y. Cooper	*Henderson*	*Vance*
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Professor of Botany, B.S., M.S., Oklahoma University; Ph.D., University of California.
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Associate Professor of Modern Languages, B.A., M.A., University of North Carolina.
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Associate Professor of Horticulture, B.S., Rutgers University; M.S., Ph.D., Michigan State University.
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Professor of Poultry Science, D.V.M., Colorado State University; Ph.D., Cornell University.
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*ALDOS C. BAREFOOT,
Assistant Professor of Forest Utilization, B.S., M. Wood Tech., North Carolina State College.
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Head of Zoology Faculty and Professor of Zoology, B.S., Georgia School of Technology; M.S., Ph.D., University of Michigan.
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Instructor in English, A.B., Salem College; M.A., University of North Carolina.
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Associate Professor of History and Political Science, A.B., Trinity College; A.M., University of Wisconsin.
WILLIAM JOSEPH BARNHART,
Assistant Professor of English, A.B., University of Tennessee; M.A., Ph.D., University of North Carolina.

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* On leave of absence

WILLIAM JAMES BARON,
Instructor in Product Design, B.A. in Industrial Design, University of Illinois.
JAMES FREDERICK BARRETT,
Assistant Professor of Military Science, Major, U.S. Army, B.A., Wesleyan University.
ELLIOTT RAY BARRICK,
Head of Animal Husbandry Section and Professor of Animal Industry, B.S., Oklahoma A.&M. College; M.S., Ph.D., Purdue University.
WILLIAM VICTOR BARTHOLOMEW,
Professor of Soils, B.S., Brigham Young University; M.S., Ph.D., Iowa State University.
ANDREW JACKSON BARTLEY,
Associate Professor of Economics, B.A., B.S., M.A., University of Missouri.
EDWARD GUY BATTE,
Head, Veterinary Section and Professor of Animal Industry, B.S., M.S., D.V.M., A.&M. College of Texas.
ERNEST OSCAR BEAL,
Associate Professor of Botany, B.A., North Central College; M.S., Ph.D., State University of Iowa.
HOMER EDWIN BEAM,
Visiting Lecturer in Agricultural Education, B.S., M. of Agricultural Education, North Carolina State College.
HARRY GEDDIE BEARD,
Instructor in Agricultural Education, B.S., M. of Agricultural Education, North Carolina State College.
EUSTACE O. BEASLEY,
Research Instructor in Agricultural Engineering, B.S., North Carolina State College.
KENNETH ORION BEATTY, JR.,
Professor of Chemical Engineering, B.S. Ch.E., M.S., Lehigh University; Ph.D., University of Michigan.
NEIL McLAURIN BEATTY,
Instructor in Engineering Graphics, B.S., North Carolina State College.
JAMES F. BEEMAN,
Instructor in Agricultural Engineering, B.S., M.S., Pennsylvania State University.
BURTON FLOYD BEERS,
Assistant Professor of History and Political Science, B.A., Hobart College, M.A., Ph.D., Duke University.
NORMAN ROBERT BELL,
Associate Professor of Electrical Engineering, B.S., Lehigh University; M.S., Cornell University.
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Associate Professor of Animal Industry, B.S., Wofford College; M.S., North Carolina State College.
WILLIAM CALLUM BELL,
Research Professor of Ceramic Engineering, B.S., North Carolina State College; M.S., Ph.D., Ohio State University.
RICHARD NEIL BERRIER,
Research Assistant of Textile Research, B.S., North Carolina State College.
ERNEST BEZOLD BERRY,
Assistant Professor of Textiles, B.S., Clemson College.
BIBHUTI BHUSHAN BHATTACHARYYA,
Visiting Associate Statistician of Experimental Statistics, B. S., Presidency College; M.S., Calcutta University; Ph.D., London School of Economics and Political Science.
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Assistant Professor of Civil Engineering, B.S., Michigan State College; M.S.C.E., North Carolina State College.
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Instructor in Mathematics, A.B., University of Missouri; M.S., University of Iowa.
CHARLES EDWIN BISHOP,
Head of Department and William Neal Reynolds Professor of Agricultural Economics, B.S., Berea College; M.S., University of Kentucky; Ph.D., University of Chicago.
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Assistant Professor in Chemistry, B.S., Presbyterian College; M.A., University of North Carolina.
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Associate Professor of History and Political Science, B.S., Eastern Illinois State College; M.A., Ph.D., University of Illinois.
WILLIAM LOWRY BLOW,
Assistant Professor of Poultry Science, B.S., M.S., Ph.D., North Carolina State College.
GEORGE BENJAMIN BLUM, JR.,
Assistant Professor of Agricultural Engineering, B.S., M.S., North Carolina State College.
THOMAS NELSON BLUMER,
Professor of Animal Industry, B.S., Pennsylvania State College; Ph.D., Michigan State College.
JOHN FRANCIS BOGDAN,
Professor of Textiles and Director of Processing Research, B.T.E., Lowell Textile Institute.

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* On leave of absence

CAREY HOYT BOSTIAN,
Professor of Genetics, 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.

HENRY DITTIMUS BOWEN,
Associate Professor of Agricultural Engineering, B.S., M.S., Ph.D., Michigan State College.

THOMAS GLENN BOWERY,
Research Professor of Plant Chemistry (Field Crops), B.S., Michigan State University; M.S., Ph.D., Rutgers University.

EDWARD HOSMER BRADFORD,
Associate Professor of Textiles, B.T.E., Lowell Textile Institute.

GARNETT L. BRADFORD,
Instructor in Agricultural Economics, B.S., M.S., University of Kentucky.

CHARLES RAYMOND BRAMER,
Professor of Civil Engineering, B.S.E., E.M., Michigan College of Mining and Technology.

VESTER ROBERTSON BRANTLEY,
Assistant Professor of Mathematics, B.A., M.A., Wake Forest College.

EUGENE PASCHAL BRANTLY,
Assistant Professor of Civil Engineering, B.C.E., North Carolina State College; M.S.C.E., University of Illinois.

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Associate Professor of Philosophy and Religion, B.A., University of Pennsylvania; Ph.D., Yale University.

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Associate Professor of Entomology, B.S., M.S., University of Nebraska; Ph.D., Kansas State College.

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Instructor in Social Studies, B.A., M.A., University of Mississippi.

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Associate Professor of Chemical Engineering, B.S., M.S., State University of Iowa.

FRANK ELLIOTT BRILEY,
Instructor of Industrial Arts, B.S., North Carolina State College; M.Ed., University of North Carolina.

CHARLES ALOYSIUS BRIM,
Research Associate Professor of Field Crops, B.S., M.S., Ph.D., University of Nebraska.

HALBERT FELTON BRINSON,
Instructor in Engineering Mechanics, B.C.E., North Carolina State College.

ROBERT CHARLES BROOKS,
Instructor in Agricultural Economics, B.S., M.S., North Carolina State College.

KING RICHARD BROSE,
Research Associate in Engineering Research, B.M.E., B.I.E., North Carolina State College.

EDMOND JOSEPH BROWN,
Assistant Professor of Physics, B.S., M.S., North Carolina State College.

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Assistant Professor of Geological Engineering, A.B., Berea College; M.S., Ph.D., University of Illinois.

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Professor of History and Political Science, A.B., Haverford College; A.M., Ph.D., University of Pennsylvania.

TALMAGE THURMAN BROWN,
Associate Professor of Poultry Science, B.S., M.S., North Carolina State College.

*THEODORE CECIL BROWN,
Associate Professor of Mechanical Engineering, B.S.M.E., M.E., University of Kentucky; M.S., North Carolina State College.

CHARLES DOUGLAS BRYANT,
Instructor in Agricultural Education, B.S., M. of Agricultural Education, North Carolina State College.

RALPH C. BRYANT,
Professor of Forest Economics, B.S., M.F., Yale University; Ph.D., Duke University.

PAUL BUISSON,
Visiting Assistant Professor of Architecture, French Government Diploma in Arch., Ecole Nationale Superieure des Beaux-Arts, Paris, France.

ROBERT COZART BULLOCK,
Professor of Mathematics, B.A., M.A., University of North Carolina; Ph.D., University of Chicago.

HARVEY LINDY BUMGARDNER,
Assistant Professor of Poultry Science, B.S., North Carolina State College; M.S., Ph.D., University of Maryland.

*ROBERT LOGAN BUNTING,
Associate Professor of Economics, M.A., Ph.D., University of Chicago.

ROBERT PASCHAL BURNS, JR.,
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GEORGE CHARLES CALDWELL,
Associate Professor of Mathematics, A.B., M.A., University of North Carolina.

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* On leave of absence

JOHN TYLER CALDWELL,
Chancellor of North Carolina State College and Professor of Political Science, B.S., Mississippi State College; M.A., Duke University; M.A., Columbia University; Ph.D., Princeton University.

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Visiting Professor of Architecture, Dipl. in Arch., University of Buenos Aires.

KENNETH STODDARD CAMPBELL,
Professor of Textile Chemistry, B.S., Clemson College; B.S., Bates College.

MALCOLM EUGENE CAMPBELL,
Dean of the School of Textiles, Graduate of the New Bedford Textile Institute; B.S., Clemson College; M.S.C. (Hon.), New Bedford Institute of Technology; D.Tex., Philadelphia Textile Institute; D.Tex., Clemson College; Dr. Honoris Causa, National University of Engineering, Peru.

WILLIAM VERNON CAMPBELL,
Assistant Professor of Entomology, B.S., M.S., Mississippi State College; Ph.D., North Carolina State College.

EMMETT JOHN CANADAY,
Assistant Professor of Mathematics, B.A., William Jewell College; M.A., University of Missouri.

THOMAS FRANKLIN CANNON,
Assistant Professor of Horticulture, B.S., M.S., North Carolina State College; Ph.D., Ohio State University.

THELMA JOYCE CARAWAY,
Instructor of Mathematics, A.B., Alabama College; M.A., University of Arkansas.

IRVING THEODORE CARLSON,
Assistant Professor of Field Crops, B.S., M.S., Washington State College; Ph.D., University of Wisconsin.

ALEXANDER A. CARLYLE,
Research Engineer, B.S., North Carolina State College.

ADGER B. CARROLL,
Instructor in Agricultural Economics, B.S., M.S., Clemson College.

ROBERT GORDON CARSON, JR.,
Director of Instruction, School of Engineering, and Professor of Industrial Engineering, B.S., Clemson College; M.S., Georgia Institute of Technology; Ph.D., University of Michigan.

HAROLD B. CARTER,
Operations Engineer, Nuclear Reactor Project, B.S., North Carolina State College.

ROY MERWIN CARTER,
Professor of Wood Technology, B.S.F., University of Minnesota; M.S., Michigan State College.

LEO THOMAS CARUTHERS, JR.,
Radiological Safety Officer of the Safety and Health Committee, B.S., University of Richmond.

DAVID MARSHALL CATES,
Assistant Director, Chemical Research, Department of Textile Research, and Associate Professor of Textile Chemistry, B.S., M.S., North Carolina State College; M.A., Ph.D., Princeton University.

JOHN WESLEY CELL,
Head of Department and Professor of Mathematics, B.A., M.A., Ph.D., University of Illinois.

ROBERT DONALD CESS,
Associate Professor of Mechanical Engineering, B.S.M.E., Oregon State College; M.S.M.E., Purdue University; Ph.D., University of Pittsburgh.

RICHARD BRUCE CHALFANT,
Assistant Professor of Entomology, B.S., University of Akron; M.S., Ph.D., University of Wisconsin.

DOUGLAS SCALES CHAMBLEE,
Professor of Field Crops, B.S., M.S., North Carolina State College; Ph.D., Iowa State University.

LARRY STEPHEN CHAMPION,
Instructor in English, A.B., Davidson College; M.A., University of Virginia.

JESSE CHAPPELL, JR.,
Research Assistant of Textile Research, B.S., North Carolina State College.

JOE SENTER CHAPPELL,
Research Assistant of Agricultural Economics, B.S., North Carolina State College; M.S., Oklahoma State University.

MARY ANN CIPOLIONI,
Assistant Statistician of Experimental Statistics, B.A., M.S., West Virginia University.

JOSEPH DEADRICK CLARK,
Professor of English, B.A., Columbia University; M.A., Harvard University.

LEWIS JAMES CLARKE,
Visiting Associate Professor of Landscape Architecture; Dipl. in Arch., School of Arch., Leicester; Dipl. in L.D., Kings College, University of Durham, England; M.L.A., Harvard University.

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Assistant Professor of Air Science, B.A., Wake Forest College.

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Professor of Mathematics, B.A., Wofford College; M.A., Duke University; Ph.D., Cornell University.

JOSEPH RAY CLARY,
Instructor in Agricultural Education, B.S., M. of Agricultural Education, North Carolina State College.

ALBERT J. CLAWSON,
Assistant Professor of Animal Industry, B.S., University of Nebraska; M.S., Kansas State College; Ph.D., Cornell University.
CARLYLE NEWTON CLAYTON,
Professor of Plant Pathology, B.S., Clemson College; Ph.D., University of Wisconsin.
MAURICE HILL CLAYTON,
Assistant Professor of Engineering Mechanics, B.S., Wake Forest College; M.E.Math., North Carolina State College.
JOHN L. CLEMENTS,
Instructor in Physical Education, B.S., M.A., University of North Carolina.
GROVER CLEVELAND COBB,
Assistant Professor of Physics, B.S., M.S., University of Georgia; Ph.D., University of Virginia.
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Assistant Professor of Air Science, B.A., Texas Christian University.
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Head of Department and Professor of Horticulture, B.S., Clemson College, M.S., Louisiana State University, Ph.D., University of California.
COLUMBUS CLARK COCKERHAM,
Professor of Experimental Statistics and Genetics, B.S., M.S., North Carolina State College; Ph.D., Iowa State College.
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Instructor in Social Studies, A.B., Oberlin College; M.A., Princeton University.
*NATHANIEL TERRY COLEMAN,
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Assistant Professor of Sociology and Anthropology, B.A., Brooklyn College; M.A., Duke University.
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WILLIAM STOKES CONNOR, JR.,
Adjunct Professor of Experimental Statistics, B.S., Davidson College, M.A., Ph.D., University of North Carolina.
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Assistant Professor of Poultry Science, B.S., M.S., North Carolina State College, Ph.D., Agricultural and Mechanical College of Texas.
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Associate Professor of Psychology, B.A., University of Chicago; M.A., University of Iowa; Ph.D., New York University.
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Assistant Professor of Mathematics, B.S., M.S., North Carolina State College.
ARTHUR WELLS COOPER,
Assistant Professor of Botany, B.A., M.A., Colgate University; Ph.D., University of Michigan.
NELVILLE E. COOPER,
Instructor in Physical Education, B.S., Elon College; M.A., University of North Carolina.
WILLIAM EARL COOPER,
Associate Professor of Plant Pathology, B.S., Arkansas State A.&M. College, M.S., Oklahoma A.&M. College, Ph.D., Louisiana State University.
ALONZO FREEMAN COOTS,
Associate Professor of Chemistry, B.E., Ph.D., Vanderbilt University.
RALPH LELAND COPE,
Assistant Professor of Industrial Engineering, B.S.M.E., B.S.Ind.E., M.Ed., Pennsylvania State University.
WILL ALLEN COPE,
Research Assistant Professor of Field Crops, B.S., M.S., Auburn Uuniversity, Ph.D., North Carolina State College.
FRANKLIN E. CORRELL,
Assistant Professor in Horticulture, B.S., M.S., North Carolina State College.
HAROLD MAXWELL CORTER,
Professor of Psychology, B.S., State Teachers College (Lock Haven, Pa.); M.Ed., Ph.D., Pennsylvania State University.
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Industrial Waste Specialist, B.S. in C.E., Duke University.
ARTHUR JAMES COUTU,
Associate Professor of Agricultural Economics, B.S., M.S., University of Connecticut; Ph.D., North Carolina State College.
STUART D. COWARD,
Research Associate in Industrial Experimental Program, M.S., Syracuse University; B.S., Tri-State College.
JOSEPH H. COX,
Associate Professor of Design, B.F.A., John Herron Art School; M.F.A., University of Iowa.

---

* On leave of absence

DORIS LEE CRAIG,
Research Instructor in Soils, B.A., Winthrop College; M.A., University of North Carolina.
FRANK RANKIN CRAIG,
Associate Professor of Poultry Science, B.S., M.S., North Carolina State College; D.V.M., University of Georgia.
*HARRIS BRADFORD CRAIG,
Instructor in Animal Industry, B.S., Clemson College; M.S., North Carolina State College.
MAX ARNOLD CRAIG,
Assistant Professor of Military Science, Captain, Ordnance Corps, U. S. Army, B.S., Clemson A and M.
WINIFRED HARDISON CRANOR,
Research Instructor in Textile Research, B.S., Woman's College of the University of North Carolina.
ALBERT CRAWFORD,
Assistant Professor of Recreation and Park Administration, B.S., Appalachian State Teachers College; M. Ed., University of North Carolina.
PAUL DAY CRIBBINS,
Assistant Professor of Civil Engineering, B.S. Marine Transp., U. S. Merchant Marine Academy; B.S.C.E., University of Alabama; M.S.C.E., Ph.D., Purdue University
ARTHUR JAMES CROWLEY,
Research Instructor in Field Crops, B.S., Illinois State Normal University; M.S., University of Illinois.
KELLY RAYGENE CRUMP,
Instructor in Engineering Graphics, B.S., North Carolina State College.
MAYNARD CLARENCE CUSWORTH,
Assistant Professor of Air Science, B.S., University of Illinois.
PHILIP HARVEY DAVIS,
Associate Professor of English, B.A., M.A., Miami University.
WILLIAM ROBERT DAVIS,
Assistant Professor of Physics, B.S., M.S., University of Oklahoma; Ph.D., University of Gottingen, Germany.
STEPHEN WALLACE DERBYSHIRE,
Research Associate in Engineering Research, B.S. in Ceramic Engineering, North Carolina State College.
PAUL HAROLD DERR,
Head of Department and Professor of Physical Education, B.S., University of Illinois; M.A., New York University.
JAMES WILLIAM DICKENS,
Research Instructor of Agricultural Engineering, B.S., M.S., North Carolina State College.
EARL ROGER DICKEY,
Assistant Professor of Air Science, B.S., University of Maryland.
CHARLES WILLIAM DILL,
Instructor of Animal Industry, B.S., Berea College; M.S., North Carolina State College.
EMMETT URCEY DILLARD,
Associate Professor of Animal Industry, B.S., Berea College; M.S., North Carolina State College; Ph.D., University of Missouri.
DANIEL ROBERT DIXON,
Lecturer in Economics, A.B., College of William and Mary; LL.B., Duke University; LL.M., New York University.
WESLEY OSBORNE DOGGETT,
Associate Professor of Physics, B.N.E., B.E.E., North Carolina State College; M.A., Ph.D., University of California, Berkeley
JESSE SEYMOUR DOOLITTLE,
Professor of Mechanical Engineering, B.S., Tufts College; M.S., Pennsylvania State College.
ROBERT ALDEN DOUGLAS,
Associate Professor of Engineering Mechanics, B.S., M.S., Ph.D., Purdue University.
JOSEPH CLYDE DOWDLE,
Instructor in Electrical Engineering, B.S., E.E., Alabama Polytechnic Institute; M.S., E.E., Alabama Polytechnic Institute.
MURRAY SCOTT DOWNS,
Assistant Professor of History and Political Science, B.A., Randolph-Macon College; M.A., Ph.D., Duke University.
DONALD WILLIAM DREWES,
Assistant Professor of Psychology, B.S., Iowa State College; M.A., State University of Iowa; Ph.D., Purdue University.
JOHN WESLEY DUDLEY,
Research Assistant Professor of Field Crops, B.S., Purdue University; M.S., Ph.D., Iowa State University.
GEORGE HEYWARD DUNLAP,
Textile Consultant and Director of Textile Placement Bureau, B.S., Clemson College.
FRED L. EARGLE,
Industrial Specialist, B.S., North Carolina State College.
JOHN BYNUM EASLEY,
Instructor in English, B.A., M.A., University of North Carolina.
PRESTON WILLIAM EDSALL,
Head of Department and Professor of History and Political Science, B.S., New York University; A.M., Ph.D., Princeton University.

---

* On leave of absence

JENNINGS B. EDWARDS, JR.,
Associate Professor of Physical Education, B.S., North Carolina State College; M.A., University of North Carolina.

WILLIAM F. EDWARDS,
Assistant Professor of Social Studies, B.A., Amherst College; Ph.D., Columbia University.

HERBERT GARFIELD ELDRIDGE, JR.,
Assistant Professor of English, B.A., M.A., University of Pennsylvania.

GERALD HUGH ELKAN,
Assistant Professor of Bacteriology, B.A., Brigham Young University; M.S., Pennsylvania State University; Ph.D., Virginia Polytechnic Institute.

CECIL DEAN ELLIOTT,
Associate Profesor of Architecture, B.S., B.Arch., University of Oklahoma; M. Arch., Harvard University.

ROBERT NEAL ELLIOTT,
Assistant Professor of Social Studies, A.B., Appalachian State Teachers College; M.A., Ph.D., University of North Carolina.

DON EDWIN ELLIS,
Head of Plant Pathology and Professor of Plant Pathology, B.Sc., B.A., Central College; M.S., Louisiana State University; Ph.D., University of North Carolina.

*GEORGE LELAND ELLIS,
Instructor in Animal Industry, B.S., M.S., North Carolina State College.

DONALD ALLEN EMERY,
Assistant Professor of Field Crops, B.S., M.S., University of New Hampshire; Ph.D., University of Wisconsin.

CHARLES BENNETT ENGLAND,
Research Instructor in Soils, B.S., M.S., Ph.D., University of Georgia.

NORMAN GILBERT ERIKSEN,
Assistant Professor of Military Science, Captain, Infantry, U. S. Army, B.S., Virginia Polytechnic Institute.

JOHN LINCOLN ETCHELLS,
Professor of Animal Industry, Botany and Horticulture (Coop. USDA), B.S., M.S., Ph.D., Michigan State College.

HAROLD J. EVANS,
Professor of Botany; B.S., M.S., University of Kentucky; Ph.D., Rutgers University.

JAMES B. EVANS,
Professor of Bacteriology, B.S., Houghton College; Ph.D., Cornell University.

JAMES PEEK EVERETT, JR.,
Assistant Professor of Animal Industry, B.S., Alabama Polytechnic Institute; M.S., University of Kentucky; Ph.D., Michigan State University.

RALPH EIGIL FADUM,
Head of Department and Professor of Civil Engineering; B.S.C.E., University of Illinois; M.S.E., S.D., Harvard University.

EMOL ATWOOD FAILS,
Associate Professor of Economics, B.S., Southwestern Institute of Technology, Oklahoma; M.A., Ph.D., Peabody College.

DAVID IRVING FAIRBANKS,
Instructor in Electrical Engineering, B.S., E.E., Syracuse University; M.S., University of Buffalo.

MAURICE HUGH FARRIER,
Research Assistant Professor of Entomology, B.S., M.S., Iowa State College; Ph.D., North Carolina State College.

WILLIAM THOMAS FIKE,
Assistant Professor of Field Crops, B.S., M.S., Pennsylvania State University.

ALVA LEROY FINKNER,
Adjunct Professor of Experimental Statistics, B.S., Colorado A. & M. College; M.S., Kansas State College; Ph.D., North Carolina State College.

WALTER LEE FISHEL,
Instructor in Agricultural Economics, B.S., M.S., Purdue University.

CHARLES PAGE FISHER, JR.,
Instructor in Civil Engineering, B.C.E., University of Virginia; S.M., Harvard University.

JAMES WALTER FITTS,
Head of Department and Professor of Soils, B.S., Nebraska State Teachers College; M.S., University of Nebraska; Ph.D., Iowa State College.

WALTER CURTIS FITZGERALD, JR.,
Assistant Professor of Philosophy and Religion, B.S., Wake Forest College; B.D., Southern Baptist Theological Seminary.

*JACK FLEISCHER,
Assistant Professor of Experimental Statistics, B.S., University of Florida; M.S., North Carolina State College.

HARRON O'BERRY FLOYD, JR.,
Instructor in Physical Education, B.A., Wake Forest College; M.A., University of North Carolina.

HOMER CLIFTON FOLKS,
Assistant Director of Instruction, School of Agriculture; Director of the North Carolina Agricultural Institute; Associate Professor of Soils, B.S., Oklahoma A. & M.; Ph.D., Iowa State College.

JULIAN MARK FORE,
Professor of Agricultural Engineering, B.S., Virginia Polytechnic Institute; M.S., Purdue University.

---

* On leave of absence

CHARLES IRVING FOSTER,
Professor of Social Studies, B.A., Princeton University; M.A., Harvard University.
ALVIN MARCUS FOUNTAIN,
Professor of English, B.E., M.S., North Carolina State College; M.A., Columbia University; Ph.D., Peabody College.
ANNA CLYDE FRAKER,
Research Assistant in Engineering Research, B.S., Furman University.
RAOUL MANUEL FREYRE,
Assistant Professor in Physics, Ph.D., University of Havana, Cuba.
DANIEL FROMM,
Associate Professor of Poultry Science, B.S., M.S., Ph.D., Pennsylvania State College.
ARCHIE WAYLAND FUTRELL, JR.,
Assistant Professor of Mechanical Engineering, B.M.E., M.S., North Carolina State College.
GENE JOHN GALLETTA,
Assistant Professor in Horticulture, B.S., University of Maryland; M.S., Rutgers University.
GERALD GARB,
Assistant Professor of Economics, B.S., University of Pennsylvania, M.A., Ph.D., University of California.
BERT HOWARD GARCIA, JR.,
Associate Professor of Mechanical Engineering, B.S.M.E., M.S.M.E., Pennsylvania State University.
MONROE EVANS GARDNER,
Professor of Horticulture, B.S., Virginia Polytechnic Institute.
THOMAS HAROLD GARNER,
Research Instructor in Agricultural Engineering B.S., M.S., North Carolina State College.
HENRY WILBUR GARREN,
Head of Department and Professor of Poultry Science, A.B., University of North Carolina; B.S., North Carolina State College; M.S., Ph.D., University of Maryland.
MARTHA JOHNSON GARREN,
Instructor in Mathematics, A.B., University of North Carolina.
JOHN BERNARD GARTNER,
Professor of Horticulture, B.S., Ohio State University; M.S., Ph.D., Michigan State College.
ROBERT THEODORE GAST,
Research Assistant Professor of Entomology, B.S., M.S., Ohio State University; Ph.D., Cornell University.
PAUL ESCH GATTERDAM,
Research Assistant Professor of Plant Chemistry (Field Crops), B.S., M.S., Ph.D., University of Wisconsin.
FRANK GEORGE GERLOCK,
Instructor in Zoology, B.S., University of Alabama; M.A., Columbia University.
EDMUND JOSEPH GERNT,
Research Assistant of Textile Research, Certificate Rhode Island School of Design; Diploma, La Salle Extension University.
DAN ULRICH GERSTEL,
Professor of Field Crops, B.S., M.S., Ph.D., University of California.
WILLIAM BEST GILBERT,
Assistant Professor of Field Crops, B.S., Berea College; M.S., University of Kentucky; Ph.D., North Carolina State College.
*GEORGE WALLACE GILES,
Professor of Agricultural Engineering, B.S., University of Nebraska; M.S., University of Missouri.
ROBERT C. GILMORE,
Superintendent Wood Products Laboratory, B.S., Pennsylvania State College.
EDWARD WALKER GLAZENER,
Director of Instruction, School of Agriculture, and Professor of Poultry Science, B.S., North Carolina State College; M.S., Ph.D., University of Maryland.
KARL BROWNING GLENN,
Associate Professor of Electrical Engineering, B.E., M.S., North Carolina State College.
THOMAS MARION GODBOLD,
Instructor in Chemical Engineering, B.S., University of South Carolina.
MARVIN RALPH GODFREY,
Research Assistant of Field Crops (NCCIA), B.S., North Carolina State College.
ALFRED JOHN GOETZE,
Associate Professor of Electrical Engineering, B.S., E.E., Drexel Institute of Technology: M.Sc., North Carolina State College.
SAMUEL TURNER GOFORTH, JR.,
Instructor in Chemical Engineering, B.S., University of South Carolina; M.S., North Carolina State College.
GENNARO LOUIS GOGLIA,
Associate Professor of Mechanical Engineering, B.S.M.E., University of Illinois; M.S.M.E., Ohio State University; Ph.D., University of Michigan
*RICHARD WEINBERG GOLDSMITH.
Assistant Professor of English, A.B., M.A., Ph.D., University of North Carolina.
EUGENE FRIZZELLE GOLDSTON,
Research Assistant Professor of Soils, B.S., North Carolina State College.

---

* On leave of absence

CHARLES FRANCIS GOLDTHWAIT,
Visiting Professor of Textile Chemistry, B. S. Worcester Polytechnic Institute.
LEMUEL GOODE,
Associate Professor of Animal Industry, B.S., M.S., West Virginia University; Ph.D., University of Florida.
ARNOLD HERBERT EDWARD GRANDAGE,
Associate Professor of Experimental Statistics, B.A., Lehigh University; Ph.D., North Carolina State College.
CLIFTON WILLINGTON GRAY,
Assistant Professor of Psychology and Experimental Statistics, B.S., U. S. Military Academy; M.S., Ph.D., University of Minnesota.
JOHN HAYES GREGORY,
Instructor in Animal Industry, B.S., M.S., North Carolina State College.
WALTON CARLYLE GREGORY,
William Neal Reynolds Distinguished Professor of Field Crops, B.A., Lynchburg College; M.A., Ph.D., University of Virginia; D.Sc., Lynchburg College.
HAZEL CORNELIA GRIFFIN,
Special Lecturer in English, A.B., University of North Carolina; M.S., North Carolina State College.
DANIEL SWARTWOOD GROSCH,
Professor of Genetics, B.S., Moravian College; M.S., Lehigh University; Ph.D., University of Pennsylvania.
*HARRY DOUGLASS GROSS,
Assistant Professor of Field Crops, B.S., M.S., Rutgers University; Ph.D., Iowa State University.
ELLIOT BROWN GROVER,
Head of Department of Textile Technology, and Abel C. Linberger Professor of Yarn Processing, B.S., Massachusetts Institute of Technology.
RUTH BORDERS GUIN,
Instructor of Textile Technology, B.S., Furman University; M.S., Woman's College of the University of North Carolina.
GEORGE ALBERT GULLETTE,
Head of Department and Professor of Social Studies, A.B., Harvard University; M.A., Vanderbilt University; Ph.D., University of Michigan.
ROY GUSSOW,
Professor of Design, B.S. in Product Design, Institute of Design.
FRANK EDWIN GUTHRIE,
Associate Professor of Entomology, B.S., University of Kentucky; M.S., Ph.D., University of Illinois.
GEORGE RICHARD GWYNN,
Research Assistant Professor of Field Crops, B.S., M.S., North Carolina State College; Ph.D., Iowa State University.
FRANK ARLING HAASIS,
Professor of Plant Pathology, B.S., University of California; Ph.D., Cornell University.
WILLIAM CULLEN HACKLER,
Associate Professor of Ceramic Engineering, B. Cer. E., M.S. Cer. E,, Virginia Polytechnic Institute; Ph.D., North Carolina State College.
ROBERT JOHN HADER,
Professor of Experimental Statistics, B.S., University of Chicago; Ph.D., North Carolina State College.
FREDERICK MORGAN HAIG,
Professor of Animal Industry, B.S., University of Maryland; M.S., North Carolina State College.
JOHN LOVELL HALL,
Instructor in Plant Chemistry (Field Crops), B.S., North Carolina State College; M.A., University of North Carolina.
RUTH BADGER HALL,
Assistant Professor of Modern Languages, B.A., Oberlin College; M.A., University of North Carolina.
ERNEST MILTON HALLIDAY,
Professor of Social Studies, B.S., M.A., Ph.D., University of Michigan.
MAX HALPEREN,
Assistant Professor of English, B.S., City College of New York; M.A., Florida State University; Ph.D., Florida State University.
DAME SCOTT HAMBY,
Associate Professor of Textiles, B.S., Alabama Polytechnic Institute.
CHARLES HORACE HAMILTON,
Professor of Rural Sociology, B.A., Southern Methodist University; M.S., A. & M. College of Texas; Ph.D., University of North Carolina.
ROBERT HILLERY HAMILTON,
William Neal Reynolds Research Assistant Professor of Field Crops, B.S., University of Illinois; M.S., Ph.D., Michigan State University.
ALICE ELIZABETH HAMMOND,
Research Assistant of Textile Research, A.B., University of Mississippi; M.A., Peabody College for Teachers.
DURWIN M. HANSON,
Professor of Industrial Education, B.S., M.S., Ph.D., Iowa State College.
KARL P. HANSON,
Professor of Mechanical Engineering, B.S., University of Wisconsin; M.S., University of Michigan.

---

* On leave of absence

JAMES WALKER HARDIN,
Assistant Professor of Botany, B.S., Florida Southern College; M.S., University of Tennessee; Ph.D., University of Michigan.
HARRY ALLEN HARGRAVE,
Instructor in English, B.A., M.A., Vanderbilt University.
REINARD HARKEMA,
Professor of Zoology, A.B., Calvin College; Ph.D., Duke University.
SADIE JENKINS HARMON,
Assistant Professor of English, A.B., B.M., Greensboro College; M.A., Ph.D., University of North Carolina.
CLEON HARRELL,
Associate Professor of Economics, B.S., M.A., University of Virginia.
GEORGE OLIVER HARRELL,
Instructor in Ceramic Engineering, B.S., North Carolina State College.
WALTER JOEL HARRINGTON,
Professor of Mathematics, B.A., M.A., Ph.D., Cornell University.
*EDGAR LEE HARRISBERGER,
Associate Professor of Mechanical Engineering, B.S.M.E., University of Oklahoma; M.S.M.E., University of Colorado.
CLARENCE A. HART,
Assistant Professor of Wood Technology, B.S., Virginia Polytechnic Institute; M.S., Ph.D., North Carolina State College.
LODWICK CHARLES HARTLEY,
Head of Department and Professor of English, B.A., Furman University; M.A., Columbia University; Ph.D., Princeton University; Litt.D. (Hon.), Furman University.
PAUL HENRY HARVEY,
Head of Department and William Neal Reynolds Distinguished Professor of Field Crops, B.S., University of Nebraska; Ph.D., Iowa State University.
FRANCES JEFFERSON HASSLER,
Head of Department and William Neal Reynolds Professor of Agricultural Engineering, B.S., University of Missouri; M.S., Ph.D., Michigan State College.
WILLIAM WALTON HASSLER,
Associate Professor of Zoology, B.S., M.S., Cornell University; Ph.D., University of Tennessee.
ARTHUR COURTNEY HAYES,
Associate Professor of Textile Chemistry, M.S., North Carolina State College; Ph.D., Brown University.
FRANK LLOYD HAYNES, JR.,
Professor of Horticulture, B.S., Alabama Polytechnic Institute; Ph.D., Cornell University.
TEDDY THEODORE HEBERT,
Professor of Plant Pathology, B.S., Southwestern Louisiana Institute; M.S., Louisiana State University; Ph.D., North Carolina State College.
JOSEPH LEON HELGUERA,
Assistant Professor of History and Political Science, B.A., Mexico City College; M.A., Ph.D., University of North Carolina.
WARREN ROBERT HENDERSON,
Assistant Professor of Horticulture, B.S., University of New Hampshire; M.A., Harvard University; Ph.D., Ohio State University.
WILLIAM ROBERT HENDLEY,
Instructor in Economics, B.A., Yale University.
WILLIAM RAY HENRY,
Associate Professor of Agricultural Economics, B.S., M.S., University of Arkansas; Ph.D., North Carolina State College.
WILEY HICKS HENSON, JR.,
Research Instructor in Agricultural Engineering, B.S., University of Georgia; M.S., North Carolina State College.
JOHN HERTZMAN,
Assistant Professor of Design; B.S., Illinois Institute of Technology.
FRANCIS EUGENE HESTER,
Assistant Professor of Zoology, B.S., M.S., North Carolina State College; Ph.D., Auburn University.
ROY SCOTT HICKMAN,
Assistant Professor of Mechanical Engineering, B.S., Ph.D., University of California, Berkeley.
WILLIAM NORWOOD HICKS,
Head of Department and Professor of Philosophy and Religion, B.E., M.S., North Carolina State College; B.A., Duke University; M.A., Oberlin College.
WILLIAM LAWRENCE HIGHFILL,
Assistant Professor of Philosophy and Religion, B.A., Wake Forest College; B.D., Southern Baptist Theological Seminary; Ph.D., Duke University.
*CHARLES HORACE HILL,
Professor of Poultry Science, B. S., Colorado State University; M.S., Ph.D., Cornell University.
THOMAS IRA HINES,
Head of Department and Professor of Recreation and Park Administration, B.S., North Carolina State College; M.A., University of North Carolina.
JUAN EDWARDO HISADA,
Research Assistant of Textile Research, B.S., North Carolina State College.

---

* On leave of absence

ROBERT G. HITCHINGS,
Associate Professor of Pulp and Paper Technology, B.S., New York State College of Forestry; M.F., Duke University.
GEORGE BURNHAM HOADLEY,
Head of Department and Professor of Electrical Engineering, B.S., Swarthmore College; M.Sc., D.Sc., Massachusetts Institute of Technology.
ARTHUR MABON HOCH,
Assistant Professor of Physical Education, B.S., Wake Forest College; M.Ed., University of North Carolina.
CHARLES SASNETTE HODGES,
Research Assistant Professor of Forest and Plant Pathology, B.S., M.S., University of Idaho; Ph.D., University of Georgia.
FORNEY MOORE HOKE, JR.,
Research Engineer of Engineering Research, B.S., North Carolina State College.
ABRAHAM HOLTZMAN,
Associate Professor of History and Political Science, B.S., M.A., University of California at Los Angeles; Ph.D., Harvard University.
DALE MAX HOOVER,
Assistant Professor of Agricultural Economics, B.S., M.S., Iowa State College, Ph.D., University of Chicago.
MAURICE W. HOOVER,
Associate Professor of Horticulture, B.S.A., M.S.A., Ph.D., University of Florida.
RUTH B. HONEYCUTT,
Instructor in Mathematics, A.B., Wellesley College; M.A., Duke University.
JOHN WILLIAM HORN,
Assistant Professor of Civil Engineering; B.S.C.E., West Virginia University; M.S.C.E., Massachusetts Institute of Technology.
IVAN HOSTETLER,
Head of Department and Professor of Industrial Arts, B.A., Bluffton College; M.A., Ohio State University; Ed.D., University of Missouri.
EZRA LEWIS HOWELL,
Assistant Professor of Agricultural Engineering, B.S., M.S., North Carolina State College.
MORADA ALICE HUNT,
Lecturer in Economics, A.B., University of North Carolina; LL.B., University of North Carolina Law School.
CARLTON ESTILOW HUNTER,
Instructor in Industrial Engineering, B.S., Carnegie Institute of Technology.
GEORGE HYATT, JR.,
Head of Department and Professor of Animal Industry, B.S., Michigan State College; M.S., Rutgers University.
LOREN ALBERT IHNEN,
Assistant Professor of Agricultural Economics, B.S., M.S., University of Illinois; Ph.D., Iowa State College.
WILLIAM PRENTISS INGRAM, JR.,
Assistant Professor of Chemistry, B.S., M.S., Ph.D., North Carolina State College.
RASOUL MAHMOOD ISTRABADI,
Instructor in Civil Engineering, B.S.C.E., Baghdad Engineering School, M.S.C.E., Louisiana State University.
WILLIAM ADDISON JACKSON,
Assistant Professor of Soils, B.S., Cornell University; M.S., Purdue University; Ph.D., North Carolina State College.
*GERALD BLAINE JAMES,
Associate Professor of Agricultural Education, B.S., M.S., North Carolina State College; Ed.D., University of Illinois.
HERMAN BROOKS JAMES,
Dean of the School of Agriculture and Professor of Agricultural Economics, B.S., M.S., North Carolina State College; Ph.D., Duke University.
JOHN MITCHELL JENKINS, JR.,
Professor of Horticulture, B.S., Clemson Agricultural College; M.S., Louisiana State University; Ph.D., University of Minnesota.
JOSEPH WILLIAM JENKINS,
Assistant Professor of Military Science, Major, Corps of Engineers, U. S. Army, B.A., Mercer University.
HARLEY YOUNG JENNINGS,
Research Professor of Textile Chemistry, B.S., Adrian College; M.S., Ph.D., University of Michigan.
CHIA REN JIN,
Research Assistant of Textile Chemistry, B.S., National Taiwan University; B.S., Auburn University; M.S., North Carolina State College.
E. SIGURD JOHNSON,
Professor of Furniture Manufacturing and Management, B.S., Syracuse University; M.F., Duke University.
ELMER HUBERT JOHNSON,
Associate Professor of Sociology and Anthropology, B.A., M.A., Ph.D., University of Wisconsin.
JOSEPH CLYDE JOHNSON,
Associate Professor of Psychology, B.S., State Teachers College (Troy, Ala.); M.A., Ed.D., Peabody College.

---

* On leave of absence

WILLIAM HUGH JOHNSON,
Research Instructor in Agricultural Engineering, B.S., M.S., North Carolina State College.
WILLIAM RODGERS JOHNSTON,
Instructor of Chemistry, B.S., M.S., University of North Carolina.
GUY LANGSTON JONES,
Associate Professor of Field Crops, B.S., M.S., North Carolina State College; Ph.D., University of Minnesota.
IVAN DUNLAVY JONES,
Professor of Horticulture, A.B., Nebraska Wesleyan University; Ph.D., University of Minnesota.
KENNETH ALLEN JORDAN,
Assistant Professor in Agricultural Engineering, B.S., M.S., Ph.D., Purdue University.
WILLIAM HAROLD JUSTICE,
Instructor of Animal Industry, D.V.M., University of Georgia.
CHARLES HOWARD KAHN,
Associate Professor of Architecture, A.B. Math., University of North Carolina; B. Arch., B.C.E., North Carolina State College; M.S. Struc., Massachusetts Institute of Technology.
HENRY LEVEKE KAMPHOEFNER,
Dean of the School of Design and Professor of Architecture, B.S., Architecture, University of Illinois; M.S. Arch., Columbia University.
EUGENE JOHN KAMPRATH,
Associate Professor of Soils, B.S., M.S., University of Nebraska; Ph.D., North Carolina State College.
HAROLD KEATING,
Associate Professor of Physical Education, B.S., M.Ed., Springfield College.
THERESE MARIE KELLEHER,
Assistant Professor of Genetics, B.S., Iowa State College; M.S., Ph.D., North Carolina State College.
KENNETH RAYMOND KELLER,
Assistant Director of Research in Charge of Tobacco, and Professor of Field Crops, B.S., South Dakota University; M.S., Ph.D., Iowa State College.
JOSEPH WHEELER KELLY,
Associate Professor of Poultry Science, B.S., M.S., North Carolina State College; Ph.D., Iowa State College.
ARTHUR KELMAN,
Professor of Plant Pathology, B.S., Rhode Island State College; M.S., Ph.D., North Carolina State College.
PETER JAMES KENDELL,
Assistant Statistician of Experimental Statistics, B.Sc., The London School of Economics.
JOHN FAWCETT KENFIELD, JR.,
Associate Professor of Physical Education, B.A., M.A. University of North Carolina.
JOE MASON KENYON, JR.,
Research Assistant of Field Crops, B.S., North Carolina State College.
HOWARD CARL HENRY KERNKAMP,
Professor of Animal Industry, D.V.M., Ohio State University; M.S., Iowa State University.
HENDERSON GRADY KINCHELOE,
Professor of English, B.A., University of Richmond; M.A. Harvard University; Ph.D., Duke University.
JAMES A. KING,
Research Instructor of Textile Technology, B.S., Clemson College.
RICHARD ADAMS KING,
M. G. Mann Professor of Agricultural Economics, B.S., University of Connecticut; M.S., University of California; M.P.A., Ph.D., Harvard University.
ROSA DEANS KIRBY,
Research Instructor of Textile Chemistry, B.A., Meredith College.
ELMO RONALD KIRKLAND,
Instructor in Physics, B.S., Florida Southern College; M.S., University of Miami.
JAMES BRYANT KIRKLAND,
Dean of the School of Education and Professor of Agricultural Education, B.S., Agri., M.S., University of Tennessee; Ph.D., Ohio State University.
JAMES WARREN KLIBBE,
Assistant Professor of Textiles, B.S., North Carolina State College.
DAVID MCKENDREE KLINE,
Assistant Professor of Plant Pathology, A.B., M.A., University of Virginia; Ph.D., University of Wisconsin.
GLENN CHARLES KLINGMAN,
Professor of Field Crops, B.S., University of Nebraska; M.S., Kansas State University; Ph.D., Rutgers University.
HERBERT ALLAN KNAPPENBERGER,
Instructor in Industrial Engineering, B.S., M.S.I.E., Pennsylvania State University.
RICHARD BENNETT KNIGHT,
Professor of Mechanical Engineering, B.S., University of Maryland; M.S., University of Illinois.
ALBERT SIDNEY KNOWLES, JR.,
Assistant Professor of English, B.A., M.A., University of Virginia.
KEN-ICHI KOJIMA,
Assistant Professor of Genetics, Kyoto University, Japan; Ph.D., North Carolina State College.

CHARLES FREDERICK KOLB,
Assistant Professor of History and Political Science, B.A., Drury College; M.A., University of Kentucky.
BENJAMIN GRANADE KOONCE, JR.,
Assistant Professor of English, A.B., M.A., University of North Carolina; Ph.D., Princeton University.
MAX A. KOONTZ,
Instrumentation Supervisor, Nuclear Reactor Project, B.S., North Carolina State College.
JOHN CLEMENT KOOP,
Visiting Assistant Professor of Experimental Statistics, B. S., University College; Ph.D., North Carolina State College.
INGEBORG KOOPMAN
Research Assistant of Engineering Research, Newsprochliches Madchengymnasium, Germany; Max Planck-Institut fur Metallforschung, Germany.
THOMAS RHINEHART KONSLER,
Research Instructor of Horticulture, B.S., University of Kentucky; M.S., North Carolina State College.
ROBERT RAY KORFHAGE,
Assistant Professor of Mathematics, B.S.E., M.S., University of Michigan.
WILLIAM WURTH KRIEGEL,
Professor of Ceramic Engineering, B.S.C.E., B.S. Cer.E., University of Washington; M.S. Montana School of Mines; Dr. Ing., Technische Hochschule, Hanover, Germany.
JAMIE PARKER LAMB, JR.,
Assistant Professor of Engineering Mechanics, B. S., Alabama Polytechnic Institute; M.S., Ph.D., University of Illinois.
JOHN RALPH LAMBERT, JR.,
Professor of Social Studies, A.B., Western Maryland College; M.A., Ph.D., Princeton University.
*JOE OSCAR LAMMI,
Professor of Forest Economics, B.S., M.S., Oregon State College; Ph.D., University of California.
HAROLD AUGUSTUS LAMONDS,
Associate Professor of Nuclear Engineering, B.S., North Carolina State College; M.S., Ph.D., North Carolina State College.
JOHN HAROLD LAMPE,
Dean of the School of Engineering and Professor of Electrical Engineering, B.S., M.S., Dr. Engr., Johns Hopkins University.
FORREST WESLEY LANCASTER,
Professor of Physics, B.S. Ch.E., M.S., Purdue University; Ph.D., Duke University.
CHESTER G. LANDES,
Assistant Professor of Pulp and Paper Technology, B.S., Ch.E., Ohio State University.
CAROLE SHAPIRO LASHINSKY,
Instructor of Chemistry, B.A., Western Reserve University.
LOUIE THOMAS LASSITER,
Instructor in Textiles, B.S., North Carolina State College.
JAMES GIACOMO LECCE,
Associate Professor of Animal Industry, B.A., Dartmouth College; M.S., Pennsylvania State College; Ph.D., University of Pennsylvania.
GUY RECTOR LEDBETTER,
Research Assistant of Field Crops, B.S., North Carolina State College.
THOMAS BENSON LEDBETTER,
Assistant Professor of Mechanical Engineering, B.M.E., M.S., North Carolina State College.
JOSHUA ALEXANDER LEE,
Research Assistant Professor of Field Crops, A.B., San Diego State College; Ph.D., University of California.
RICHARD SHAO-LIN LEE,
Assistant Professor of Mechanical Engineering, B.S., National Taiwan University; M.S.M.E., North Carolina State College; Ph.D., Harvard University.
SUNG WON LEE,
Research Assistant of Textile Research, B.S., Alabama Polytechnic Institute; M.S., North Carolina State College.
JAMES EDWARD LEGATES,
Head of Animal Breeding Section and William Neal Reynolds Distinguished Professor of Animal Industry, B.S., University of Delaware; M.S., Ph.D., Iowa State College.
WILLIAM RUSSELL LEONHARDT,
Assistant Professor in Physical Education, B.S., Springfield College; M.S., University of Illinois.
PAUL BONAR LEONARD,
Associate Professor of Engineering Graphics, B.S., Ohio State University; M.A., University of North Carolina.
JACK LEVINE,
Professor of Mathematics, B.A., University of California; Ph.D., Princeton University.
CHARLES FREDERICK LEWIS,
Assistant Professor of Mathematics, B.S., Tennessee State College; M.A., Peabody College.
JOHN GARY LEWIS,
Associate Professor of Textiles, B.S., M.S., North Carolina State College.

---

* On leave of absence

WILLIAM MASON LEWIS,
Assistant Professor of Field Crops, B.S., A. & M. College of Texas; M.S., Ph.D., University of Minnesota.
PUN-DUEN (PETER) LI,
Research Assistant of Textile Research, B.S., M.S., North Carolina State College.
JOEL KARL LINDBERG,
Visiting Professor of Textile Research, B.S., Licentiate, Ph.D., Chalmers University of Technology.
QUENTIN W. LINDSEY,
Associate Professor of Agricultural Economics, B.S., M.A., University of Nebraska; Ph.D., Harvard University.
CHARLES HOWIE LITTLE, JR.,
Assistant Professor of Mathematics, B.A., Davidson College; M.A., University of North Carolina.
JAMES HENRY LITTLE, IV,
Assistant Professor in Physical Education, B.E., Central Michigan College; M.A., University of Michigan.
CHARLES DWAINE LIVENGOOD,
Research Assistant of Textile Research, B.S., North Carolina State College.
ROBERT WARREN LLEWELLYN,
Professor of Industrial Engineering, B.S.E.E., Union College; M.S.I.E., Purdue University.
RICHARD HENRY LOEPPERT,
Associate Professor of Chemistry, B.S., Northwestern University; Ph.D., University of Minnesota.
CHARLES KLEM LOMBARD,
Instructor in Physics, B.S., M.S., North Carolina State College.
GEORGE GILBERT LONG,
Assistant Professor of Chemistry, B. A., Indiana University; M.S., North Carolina State College; Ph.D., University of Florida.
KENDALL GRAHAM LORCH,
Assistant Professor of Air Science, B.S., Florida State University.
ROY LEE LOVVORN,
Director of Research for the School of Agriculture and Professor of Field Crops, B.S., Alabama Polytechnic Institute: M.S., University of Missouri; Ph.D., University of Wisconsin.
GEORGE BLANCHARD LUCAS,
Associate Professor of Plant Pathology, B.S., Pennsylvania State College; M.S., Ph.D., Louisiana State University.
HENRY LAWRENCE LUCAS, JR.,
William Neal Reynolds Distinguished Professor of Experimental Statistics, B.S., University of California; Ph.D., Cornell University.
ARTHUR EDWARD LUCIER,
Research Associate in Engineering Research, B.Cer.E., M.S., North Carolina State College.
JAMES FULTON LUTZ,
Professor of Soils, B.S., North Carolina State College; M.A., Ph.D., University of Missouri.
JOSEPH THOMAS LYNN,
Graduate Administrator and Associate Professor of Physics, B.A., Vanderbilt University; M.S., Ohio State University.
CLARK CHARLES MACOMBER,
Assistant Professor of Product Design, B.S., in Product Design, Illinois Institute of Technology.
JOHN A. MACON,
Chemical Engineer, B.S., North Carolina State College.
JAMES GRAY MADDOX,
Professor of Agricultural Economics, B.S., University of Arkansas; M.S., University of Wisconsin; M.P.A., Ph.D., Harvard University.
PRANAB K. MAITRA,
Research Assistant in Engineering Research, B.S., University of Calcutta; M.S., University of Utah.
T. EWALD MAKI,
Carl Alwin Schenck Distinguished Professor of Forest Management, B.S., M.S., Ph.D., University of Minnesota.
ARMSTRONG MALTBIE,
Assistant Professor of Mathematics, B.S., University of Vermont.
CARROLL LAMB MANN, JR.,
Professor of Civil Engineering; B.S.C.E., North Carolina State College; C. E., Princeton University.
THURSTON JEFFERSON MANN,
Professor of Field Crops, B.S., M.S., North Carolina State College; Ph.D., Cornell University.
EDWARD GEORGE MANNING,
Associate Professor of Electrical Engineering, B.S.E.E., Lehigh University; M.S., North Carolina State College.
ELIZABETH HINES MANNING,
Instructor of Chemistry, A. B., Woman's College, University of North Carolina.
HENRY VANCE MARSHALL, JR.,
Research Assistant of Botany and Bacteriology, B.S., North Carolina State College.

ROGER POWELL MARSHALL,
Professor of English, B.A., Wake Forest College; M.A., Columbia University; M.S., North Carolina State College.
CARTER WILLIAMS MARTIN,
Instructor in English, A.B., Presbyterian College; M.A., Vanderbilt University.
DAVID HAMILTON MARTIN,
Assistant Professor of Physics, B.S., Presbyterian College, South Carolina; M.S., University of Wisconsin.
DONALD CROWELL MARTIN,
Instructor in Chemical Engineering, B.S., M.S., University of South Carolina.
GRADY ALLEN MARTIN,
Assistant Professor of Poultry Science, B.S., M.S., North Carolina State College; Ph.D., Purdue University.
WILLIAM ROYAL MARTIN, JR.,
Research Associate of Textile Research, A.B., University of North Carolina; B.S., North Carolina State College.
DAVID DICKENSON MASON,
Professor of Experimental Statistics, B.A., King College; M.S., Virginia Polytechnic Institute; Ph.D., North Carolina State College.
GENNARD MATRONE,
Professor of Animal Industry, B.S., M.S., Cornell University; Ph.D., North Carolina State College.
GEORGE MATSUMOTO,
Professor of Architecture, B.A., Washington University; M.A., Cranbrook Academy of Art.
DALE FREDERICK MATZINGER,
Associate Professor of Genetics, B.S., M.S., Ph.D., Iowa State College.
ROBERT EDWARD MAY,
Research Assistant of Textile Research, B.S., North Carolina State College.
JACKSON RAMSAUR MAUNEY,
Research Assistant Professor of Field Crops, B.S., Iowa State University; M.S., Ph.D., University of Wisconsin.
SELZ CABOT MAYO,
Head of Department and Professor of Rural Sociology, A.B., Atlantic Christian College; M.S., North Carolina State College; Ph.D., University of North Carolina.
GLENN CROCKER McCANN,
Associate Professor of Rural Sociology, B.A., M.A., University of Colorado; Ph.D., Washington State College.
CHARLES BERNARD McCANTS,
Associate Professor of Soils, B.S., M.S., North Carolina State College; Ph.D., Iowa State College.
WILLIAM FRED McCLURE,
Research Instructor in Agricultural Engineering, B.S., Clemson Agricultural College.
ROBERT EDMUND McCOLLUM,
Assistant Professor of Soils, B.S., M.S., North Carolina State College; Ph.D., University of Illinois.
RALPH JOSEPH McCRACKEN,
Associate Professor of Soils, A.B. Earlham College; M.S., Cornell University; Ph.D., Iowa State College.
CHARLES RUSSELL McCULLOUGH,
Professor of Civil Engineering, B.S.C.E., M.S.C.E., Purdue University.
W. T. McDANIEL,
Chief Engineer, B.S., University of North Carolina.
PATRICK HILL McDONALD, JR.,
Head of Department and Professor of Engineering Mechanics, B.S. Engr., North Carolina State College, M.S., Ph.D., Northwestern University.
ROBERT LEE McELWEE,
Liaison Geneticist, B.S.F., West Virginia University.
LAWRENCE B. McGEE,
Research Associate in Engineering Research, B.Chem.E., North Carolina State College.
DONALD JOSEPH McGURK,
Assistant Professor of Military Science, Major, Quartermaster Corps, U. S. Army, B.S., Villanova College.
ANGUS KEITH FERGUSON McKEAN,
Professor of Social Studies, B.A., Williams College; M.A., University of Chicago; Ph.D., University of Michigan.
ROBERT ARCHIBALD MacKERRACHER,
Assistant Professor of Mathematics, Graduate, U. S. Naval Academy; M.A., University of Virginia.
CHARLES ISAAC McLAIN,
Assistant Professor of Military Science, Captain, Signal Corps, U. S. Army, B.S., North Carolina State College.
FOIL WILLIAM McLAUGHLIN,
Assistant Professor of Field Crops and Assistant Director of North Carolina Crop Improvement Association, B.S., M.S., North Carolina State College.
JOHN JOSEPH McNEILL,
Assistant Professor of Animal Industry, B.S., M.S., Ph.D., University of Maryland.
FRANCIS EDWARD McVAY,
Associate Professor of Experimental Statistics, B.S., Rhode Island State College; M.S., North Carolina State College; Ph.D., University of North Carolina.

JEFFERSON SULLIVAN MEARES,
Professor of Physics, B.S., University of South Carolina; M.S., North Carolina State College.
ADOLF MEHLICH,
Research Associate Professor of Soils, B.S., M.S., Ph.D., University of Wisconsin.
ARTHUR CLAYTON MENIUS, JR.,
Dean of the School of Physical Sciences and Applied Mathematics and Professor of Physics, B.A., Catawba College; Ph.D., University of North Carolina.
LAUREN WHITFORD MERRIAM,
Professor of Military Science, Colonel, Infantry, U. S. Army, B.S., U. S. Military Academy; Command and General Staff College; Armed Forces Staff College; Ecole Superieure de Guerre (France).
LAWRENCE EUGENE METTLER,
Assistant Professor of Genetics, A.B., Miami University; M.S., University of Kentucky; Ph.D., University of Texas.
ROBERT S. METZGER,
Assistant Professor of Social Studies, A.B., University of Wisconsin; M.A., Ph.D., Columbia University.
GEORGE WASHINGTON MIDDLETON,
Assistant Professor of Engineering Mechanics, B.S., M.E. Math., North Carolina State College.
GORDON KENNEDY MIDDLETON,
Professor of Field Crops, B.S., North Carolina State College; M.S., Ph.D., Cornell University.
HENRY MOORE MIDDLETON, JR.,
Assistant Professor of Textiles, B.S., North Carolina State College.
JOSEPH LEONARD MIDDLETON,
Associate Professor of Philosophy and Religion, B.A., Wake Forest College; B.D., Crozer Theological Seminary; M.A., Columbia University.
CONRAD HENRY MILLER,
Assistant Professor of Horticulture, B.S., M.S., Virginia Polytechnic Institute; Ph.D., Michigan State College.
EDWIN LAWRENCE MILLER, JR.,
Associate Professor of Geological Engineering, B.S., E.M., Missouri School of Mines and Metallurgy; M.S., North Carolina State College.
EMMETT HART MILLER, JR.,
Assistant Professor of Air Science, B.S., University of Maryland.
GROVER CLEVELAND MILLER,
Assistant Professor of Zoology, A.B., Berea College; M.S., University of Kentucky; Ph.D., Louisiana State University.
HOWARD GEORGE MILLER,
Head of Department and Professor of Psychology, B.S., New York State College for Teachers; M.A., Ohio State University; Ph.D., Pennsylvania State University.
LATHAM L. MILLER,
Associate Professor of Recreation and Park Administration, B.A., Wake Forest College; M.A., University of North Carolina.
PHILIP ARTHUR MILLER,
Professor of Field Crops, B.S., M.S., University of Nebraska; Ph.D., Iowa State College.
TEXTON ROBERT MILLER,
Assistant Professor of Agricultural Education, B.S., M.A., Michigan State University; Ph.D., Ohio State University.
WILLIAM DYKSTRA MILLER,
Associate Professor of Silviculture, B.A., Reed College; M.F., Ph.D., Yale University.
WILLIAM TERRELL MILLS,
Assistant Professor in Agricultural Engineering, B.S., University of Georgia; M.S., North Carolina State College.
WALTER JOSEPH MISTRIC, JR.,
Associate Professor of Entomology, B.S., Louisiana State University; M.S., Ph.D., A. & M. College of Texas.
ADOLPHUS MITCHELL,
Professor of Engineering Mechanics, B.S.C.E., M.S.C.E., University of North Carolina.
THEODORE BERTIS MITCHELL,
Professor of Entomology, B.S., Massachusetts State College; M.S., North Carolina State College; D.S., Harvard University.
RICHARD DOUGLAS MOCHRIE,
Assistant Professor in Animal Industry, B.S., M.S., University of Connecticut; Ph.D., North Carolina State College.
CARL ALBERT MOELLER,
Assistant Professor of Industrial Arts, B. A., Michigan State University; M.Ed., Wayne State University.
ROY B. MOFFITT,
Research Assistant in Engineering Research, B. Geol. E., B.Cer.E., North Carolina State College.
ROBERT HARRY MOLL,
Assistant Professor of Genetics, B.S., Cornell University; M.S., University of Idaho; Ph.D., North Carolina State College.
DANIEL JAMES MONCOL,
Assistant Professor of Animal Industry, B.S., Virginia Polytechnic Institute; D. V. M., University of Georgia.
ROBERT JAMES MONROE,
Professor of Experimental Statistics, B.S., Iowa State College; Ph.D., North Carolina State College.

ERMER LEON MOORE,
Professor of Plant Pathology, B.S., M.S.A., University of Georgia; Ph.D., University of Wisconsin.
FRANK HARPER MOORE,
Assistant Professor of English, A.B., University of Florida; M.A., Ph.D., University of North Carolina.
JAMES LEGRAND MOORE,
Research Assistant Professor of Animal Industry, B.S.Ch., Hampden-Sydney College; B.S., M.S., North Carolina State College.
HARRY BALLARD MOORE, JR.,
Instructor of Entomology, B.S., East Carolina College; M.S., Purdue University.
ROBERT PARKER MOORE,
Professor of Field Crops, B.S., Oklahoma State University; M.S., Iowa State University; Ph.D., Ohio State University.
CHARLES GALLOWAY MOREHEAD,
Associate Professor of Education, A.B., Hendrix College; M.A., Duke University, M.Ed., D.Ed., University of Kansas.
DONALD EDWIN MORELAND,
Research Assistant Professor of Field Crops, B.S., M.D., Ph.D., North Carolina State College.
JOHN WESLEY MORGAN,
Instructor of Chemistry, A.B., M.A., Duke University.
WILLIAM EDWIN MOSER,
Associate Professor of Textiles, B.S., North Carolina State College.
MARVIN KENT MOSS,
Research Assistant of Engineering Research, A.B., Elon College; M.S., North Carolina State College.
ALFRED LEROY MOWERY, JR.,
Research Assistant of Engineering Research, B.S., Duke University; M.S., North Carolina State College.
CAREY GARDNER MUMFORD,
Assistant to the Dean of the School of Physical Sciences and Applied Mathematics and Professor of Mathematics, B.A., Wake Forest College; M.A., Ph.D., Duke University.
W. RAY MURLEY,
Professor of Animal Industry, B.S., M.S., Ph.D., Iowa State College.
CHARLES FRANKLIN MURPHY,
Assistant Professor of Field Crops, B.S., Iowa State University; M.S., Purdue University.
FRANK J. MURRAY,
Assistant Professor in Physical Education, A.B., M.A., University of North Carolina.
RAYMOND LEROY MURRAY,
Head of Department and Professor of Physics, B.S., M.A., University of Nebraska; Ph.D., University of Tennessee.
RICHARD MONIER MYERS,
Assistant Professor of Animal Industry, B.S., M.S., Pennsylvania State College.
HOWARD M. NIHIKIAN,
Professor of Mathematics, B.A., M.A., Ph.D., University of North Carolina.
RICHARD ROBERT NELSON,
Associate Professor of Plant Pathology, B.A., Augsburg College; M.S., Ph.D., University of Minnesota.
HERBERT HENRY NEUNZIG,
Assistant Professor of Entomology, B.S., M.S., Ph.D., Cornell University.
SLATER EDMUND NEWMAN,
Associate Professor of Psychology, B.S., University of Pennsylvania; M.A., Boston University; Ph.D., Northwestern University.
LOWELL WENDELL NIELSEN,
Professor of Plant Pathology, B.S., M.S., Utah State Agricultural College; Ph.D., Cornell University.
DAVID EUGENE NIXON,
Instructor of Mathematics, B.S., M.S., North Carolina State College.
STUART McGUIRE NOBLIN,
Professor of History and Political Science and Archivist of the College, A.B., Davidson College; A.M., Ph.D., University of North Carolina.
ARNOLD NOLSTAD,
Associate Professor of Mathematics, B.A., Luther College; M.A., Ph.D., University of Pittsburgh.
CHARLES JOSEPH NUSBAUM,
Professor and William Neal Reynolds Distinguished Professor of Plant Pathology, B.S., Oregon State College; M.S., Ph.D., University of Wisconsin.
JIMMY R. OGBURN,
Research Engineer, B.S., Texas Technological College.
GEORGE MOTLEY OLIVER,
Instructor in Chemistry, A.B., M.S., University of North Carolina.
BERNARD MARTIN OLSEN,
Associate Professor of Economics, A.B., M.A., Ph.D., University of Chicago.
OLIVER HAMILTON ORR, JR.,
Instructor in History and Political Science, A.B., Ph.D., University of North Carolina.
*JOHN CLARK OSBORNE,
Professor of Animal Industry, B.S., Virginia Polytechnic Institute; M.S., University of Maine; D.V.M., Michigan State College.

---

* On leave of absence

HASSAN A. N. OTEIFA,
Research Assistant of Textile Research, B S., Alexandria University; M.S. in E.E., M.S. in Text., North Carolina State College.
WALTER SCOTT OVERTON,
Assistant Statistician of Experimental Statistics, B.S., M.S., Virginia Polytechnic Institute.
EDWIN HUGH PAGET,
Associate Professor of English, B.L., Northwestern University; M.A., University of Pittsburgh.
HAYNE PALMOUR, III,
Research Engineer, B.Cer.E., M.S., Georgia Institute of Technology.
CHI-HSUN (PETER) PAN,
Assistant Professor of Textile Research, B.S., Chiao Tung University; B.S., North Carolina State College; M.S., University of Michigan.
JAMES EDWARD PARDUE,
Associate Professor of Textiles, B.S., North Carolina State College.
HUBERT VERN PARK,
Professor of Mathematics, B.A., Lenoir-Ryne College; M.A., Ph.D., University of North Carolina.
THOMAS HARDIE PARK,
Assistant Professor of Economics, B.A., Vanderbilt University.
JOHN MASON PARKER, III,
Professor of Geological Engineering, B.A., M.A., Ph.D., Cornell University.
CARLOTTA PETERSON PATTON,
Instructor in Mathematics, B.S., College of Charleston.
ROBERT COPELAND PAUL,
Professor of Air Science, B.S., Georgia School of Technology.
THOMAS OLIVER PERRY,
Associate Professor of Forest Genetics, B.S., M.A., Ph.D., Harvard University.
LEE HOMER PERSON,
Research Associate Professor of Plant Pathology, B.S., Mississippi State College; M.S., Ph.D., University of Minnesota.
DANIEL McLEOD PETERSON,
Associate Professor of Mathematics, B.A., University of Mississippi; M.A., Duke University.
WALTER JOHN PETERSON,
William Neal Reynolds Distinguished Professor of Chemistry, B.S., M.S., Michigan State College; Ph.D., State University of Iowa.
WILBUR CARROLL PETERSON,
Associate Professor of Electrical Engineering, B.S.E.E., University of Minnesota; M.S., Michigan State University, Ph.D., Northwestern University.
HOWARD ALDRIDGE PETREA,
Associate Professor of Mathematics, B.S., Guilford College; M.A., University of North Carolina.
GENE HAROLD PHILLIPS,
Instructor in Engineering Graphics, B.S., North Carolina State College.
LYLE LLEWELLYN PHILLIPS,
Associate Professor of Field Crops, B.A., University of Redlands; M.A., Claremont College; Ph.D., University of Washington.
WALTER HENRY PIERCE,
Professor of Agricultural Economics, B.S., North Carolina State College; M.S., Ph.D., University of Minnesota.
JAMES RODNEY PILAND,
Research Associate Professor of Soils, B.S., Wake Forest College; M.S., North Carolina State College.
NEWBORN EARL PILAND,
Instructor in Economics, B.A., University of North Carolina.
ROBERT McLEAN PINKERTON,
Professor of Aeronautical Engineering, B.S., Bradley University.
GEORGE WAVERLY POLAND,
Head of Department and Professor of Modern Languages, B.A., College of William and Mary; M.A., Brown University; Diploma, Universidad of Salamanca; Ph.D., University of North Carolina.
DANIEL TOWNSEND POPE,
Associate Professor of Horticulture, B.S., Clemson College; M.S., Louisiana State University; Ph.D., Cornell University.
JACK PORTER,
Instructor in English, A.B., George Peabody College for Teachers; M.A., University of North Carolina.
JOSEPH ALEXANDER PORTER, JR.,
Associate Professor of Textiles, B.S., M.S., North Carolina State College.
LAURENCE ERNEST POTEAT,
Instructor in Metallurgical Engineering, B.M.E., North Carolina State College; M.S., Stanford University.
NATHANIEL THOMAS POWELL,
Assistant Professor of Plant Pathology, B.S., Virginia Polytechnic Institute; M.Sc., Ph.D., North Carolina State College.
RICHARD JOSEPH PRESTON,
Dean of the School of Forestry and Professor of Forestry, B.A., M.S.F., Ph.D., University of Michigan.
CHARLES HARRY PROCTOR,
Associate Professor of Experimental Statistics, B.A., M.A., Ph.D., Michigan State University.

THOMAS LAVELLE QUAY,
Professor of Zoology, B.S., University of Arkansas; M.S., Ph.D., North Carolina State College.
ROBERT LAMAR RABB,
Associate Professor of Entomology, B.S., M.S., Ph.D., North Carolina State College.
HAROLD ARCH RAMSEY,
Associate Professor of Animal Industry, B.S., Kansas State College; M.S., Ph.D., North Carolina State College.
GLENN ORVICE RANDALL,
Professor of Horticulture, B.S., University of Arkansas; M.S., Iowa State College.
WILLIAM HOUSTON RANKIN,
Research Associate Professor of Soils, B.S., M.S., North Carolina State College.
JOHN OREN RAWLINGS,
Assistant Statistician of Experimental Statistics, B.S., M.S., University of Nebraska; Ph.D., North Carolina State College.
HORACE DARR RAWLS,
Associate Professor of Sociology and Anthropology, B.S., M.S., North Carolina State College.
ROBERT MALCOM RAY,
Research Instructor of Agricultural Economics, B.S., North Carolina State College.
IMMO H. REDEKER,
Ore Dressing Engineer of the Minerals Research Lab, Professional Degree, University for Mining and Metallurgy; M.S., Columbia University.
ROBERT BURNETT REDFERN,
Associate Professor of Animal Industry, B.S., Clemson College; M.S., Ph.D., North Carolina State College.
JOE WILSON REECE,
Instructor of Engineering Mechanics, B.S., North Carolina State College.
EDWIN McCLUER REID,
Assistant Professor of Military Science, Major, Artillery, U. S. Army, B.A., Presbyterian College.
ELBERT REID,
Assistant Professor of Agricultural Information, B.S., M.A., Louisiana State University.
PRESTON HARDING REID,
Associate Professor of Soils, B.S., Colorado A. & M. College; M.S., Ph.D. North Carolina State College.
WILLIS ALTON REID,
Professor of Chemistry, B.S., Wake Forest College; Ph.D., University of Wisconsin.
LADISLAS FRANCIS REITZER,
Assistant Professor of History and Political Science, LL.B., Budapest, Hungary; Ph.D., Graduate Institute of International Studies, Geneva, Switzerland; Ph.D., University of Chicago.
JOHN THOMAS REVELL,
Research Assistant in Textile Research, B.S., North Carolina State College.
JAMES THOMAS RICE,
Instructor of Wood Technology, B.S., Alabama Polytechnic Institute; M.S., North Carolina State College.
JOHN CARL RICE,
Professor of Field Crops and Director of North Carolina Crop Improvement Association, B.S., M.S., Auburn University; Ph.D., Mississippi State University.
FRANCES MARIAN RICHARDSON,
Research Associate Professor of Engineering Research, B.S., Roanoke College; M.S., University of Cincinnati.
JACKSON ASHCRAFT RIGNEY,
Head of Department and Professor of Experimental Statistics, B.S., New Mexico State College; M.S., Iowa State College.
FRANKLIN LEWIS ROBERTS,
Instructor in Zoology, B.S., University of Maine; M.S., University of Canterbury.
JOHN KERR ROBERTS, JR.,
Assistant Professor of Military Science, Lieutenant Colonel, Infantry, U. S. Army, B.S., U. S. Military Academy.
WILLIAM MILNER ROBERTS,
Head, Dairy Manufacturing Section and Professor of Animal Industry, B.S.A., University of Tennessee: M.S., Ph.D., University of Minnesota.
COWIN COOK ROBINSON,
Professor of Chemistry, B.A., Sterling College, Kansas; M.A., University of Kansas; Ph.D., University of Wisconsin.
HAROLD FRANK ROBINSON,
Head of Department and Professor of Genetics and Experimental Statistics, B.S., M.S., North Carolina State College; Ph.D., Nebraska University.
MENDEL LENO ROBINSON, JR.,
Instructor of Textile Research, B.S., North Carolina State College.
ODIS WAYNE ROBISON,
Assistant Professor of Animal Industry, B.S., Oklahoma A. & M.; M.S., Ph.D., University of Wisconsin.
JOHN PAUL ROSS,
Research Assistant Professor of Plant Pathology, B.S., University of Vermont; Ph.D., Cornell University.
CHARLES WITSELL ROWAN,
Assistant Professor of Air Science, B.S., University of Georgia.
CLAUDE RUSSELL ROWELL,
Assistant Professor of Air Science, A.B., East Carolina College.

DONALD JACOB RULFS,
Associate Professor of English, B.A., University of North Carolina; M.A., Harvard University; Ph.D., University of North Carolina.
PAUL JAMES RUST,
Associate Professor of Psychology, B.A., M.A., University of Idaho; Ph.D., University of Washington.
HENRY AMES RUTHERFORD,
Head of Department of Textile Chemistry, Professor of Textile Chemistry, and Director of Chemical Research, Department of Textile Research; B.S., Davis and Elkins College; M.A., George Washington University.
JOHN ANTHONY SANTOLUCITO,
Assistant Professor of Zoology, A.B., University of California at Berkeley; Ph.D., University of California at Davis.
JOSEPH NEAL SASSER,
Associate Professor of Plant Pathology, B.S., M.S., North Carolina State College, Ph.D., University of Maryland.
GEORGE HOWARD SATTERFIELD,
Professor of Chemistry, A.B., M.A., Duke University; B.S., North Carolina State College.
KARL SAX,
Visiting Professor of Forest Genetics, B.S., Washington State College; M.S., Sc.D., Harvard University.
CLARENCE CAYCE SCARBOROUGH,
Head of the Department and Professor of Agricultural Education, B.S., M.S., Alabama Polytechnic Institute; Ed.M., Ed.D., University of Illinois.
JOACHIM-DIETRICH SCHOBEL
Visiting Research Associate of Engineering Research, Diploma-Ing., Technische Hochschule Aachen; Dr. Ing., Technesche Hochschulle Stuttgart.
EDWARD MARTIN SCHOENBORN, JR.,
Head of Department and Professor of Chemical Engineering, B.Ch.E., M.S., Ph.D., Ohio State University.
HERBERT TEMPLE SCOFIELD,
Head of Botany and Bacteriology Department and Professor of Botany, A.B., Ph.D., Cornell University.
ROBERT JOHNSON SCHRAMM, JR.,
Research Assistant Professor in Horticulture, A.B., Hiram College; M.A., Ph.D., Duke University.
JAMES ARTHUR SEAGRAVES,
Associate Professor of Agricultural Economics, B.A., Reed College; M.S., Ph.D., Iowa State College.
WAYLAND PRITCHARD SEAGRAVES,
Adjunct Professor in Electrical Engineering, B.S., M.S., North Carolina State College.
LOUIS WALTER SEEGERS,
Professor of History and Political Science, B.A., Muhlenberg College; A.M., University of Pennsylvania.
JOHN FRANK SEELY,
Associate Professor of Chemical Engineering, B.S., M.S., North Carolina State College.
HEINZ SELTMANN,
Assistant Professor of Botany; B.A., Drew University; M.S., Ph.D., University of Chicago.
JOHN IKE SEWELL,
Instructor in Agricultural Engineering, B.S., University of Georgia; M.S., North Carolina State College.
PETER SHAHDAN,
Assistant Professor of Mathematics, Ph.B., Brown University; M.S., North Carolina State College.
HENRY ANTHONY SHANNON,
Assistant Professor of Science Education, B.S., Appalachian State Teachers College; Ed.M., University of Missouri.
ARCHIE WARD SHAW,
Research Assistant of Field Crops, B.S., North Carolina State College.
GRAYE JOHNSON SHAW,
Instructor in Chemistry, B.S., M.S., North Carolina State College.
JOHN PRESTON SHAW,
Assistant Professor of Architecture, B. Arch., University of Texas; M. Arch., Massachusetts Institute of Technology.
LUTHER SHAW,
Research Associate Professor of Field Crops, B.S., North Carolina State College; M.S., University of Arkansas; Ph.D., University of Wisconsin.
BRIAN SHAWCROFT,
Visiting Assistant Professor of Architecture, Dipl. Arch., Southwest Essex Technical College and School of Art, London; M. Arch., Massachusetts Institute of Technology.
WILFRED MICHAEL SHEA,
Instructor of Physical Education, B.S., North Carolina State College; M.E., University of North Carolina.
JAMES EDWARD SHELTON,
Assistant Professor of Soils, B.S., M.S., University of Kentucky; Ph.D., North Carolina State College.
ALFRED BERNARD ROWLAND SHELLEY,
Associate Professor of English, B.S., Tufts College; M.A., Harvard University.
CHING-SHENG SHEN,
Assistant Professor of Economics, B. A., Yenching University; M.A., Boston University; Ph.D., University of North Carolina.
ROBERT TINSLEY SHERWOOD,
Assistant Professor of Plant Pathology, B.S., M.S., Cornell University; Ph.D., University of Wisconsin.

WILLIAM EDWARD SHINN,
Head of Department of Knitting Technology and Chester H. Roth Professor of Knitting Technology, School of Textiles, B.S., M.S., North Carolina State College.
JOHN WILLIAM SHIRLEY,
Dean of Faculty and Professor of English, B.A., Ph.D., State University of Iowa.
ROBERT WORTH SHOFFNER,
Assistant Director of Agricultural Extension Service, B.S., North Carolina State College.
DARRELL RHEA SHREVE,
In-Charge Computing Laboratory and Associate Professor of Mathematics, B.A., University of Tulsa; M.S., Oklahoma A. & M. College; Ph.D., University of Illinois.
CLARENCE BONNER SHULENBERGER,
Professor of Economics, B.A., Roanoke College; M.A., Columbia University.
RICHARD LEE SIMMONS,
Assistant Professor of Agricultural Economics, B.S., M.S., Kansas State University; Ph.D., University of California.
SOFUS EMMEL SIMONSEN,
Instructor of Modern Languages, Abitur Ronde, Denmark; Certificate Arhus Seminarium, Denmark.
WILLIAM HUGHES SIMPSON,
Placement Director in Engineering, B.S., Wake Forest College; M.A., Columbia University.
JUNE SINGLETARY, JR.,
Research Assistant in Engineering Research, B.S., North Carolina State College.
EARL OTIS SKOGLEY,
Instructor in Soils, B.S., M.S., North Dakota State College.
FREDERICK SILER SLOAN,
Professor of Extension Studies and Training B.S., North Carolina State College.
CHARLES SMALLWOOD, JR.,
Professor of Civil Engineering, B.S.San.E., Case Institute of Technology; M.S., Harvard University.
WILLIAM WESLEY GARRY SMART, JR.,
Associate Professor of Animal Industry and Experimental Statistics, B.S., Clemson College; M.S., Ph.D., North Carolina State College.
THOMAS BRYAN SMILEY,
Instructor in Electrical Engineering, B.S., M.S., University of North Carolina.
MICHAEL VIACHESLAV SMIRNOFF,
Associate Professor of Civil Engineering, B.S.C.E., C.E., Carnegie Institute of Technology; M.S., Ph.D., University of California at Los Angeles
BENJAMIN WARFIELD SMITH,
Professor of Genetics, B.A., M.A., University of Virginia; Ph.D., University of Wisconsin.
CLYDE FURIMAN SMITH,
Head of Entomology Faculty and Professor of Entomology, B.S., M.S., Utah State Agricultural College; Ph.D., Ohio State University.
FRANK HOUSTON SMITH,
Research Associate Professor of Animal Industry, B.S., Davidson College; M.S., North Carolina State College.
GEORGE WATSON SMITH,
Assistant Director of North Carolina Agricultural Extension Service, B.S., M.S., North Carolina State College.
J. C. SMITH,
Instructor in Civil Engineering, B.C.E., M.S.C.E., North Carolina State College.
JAMES WAYLAND SMITH,
Research Instructor in Animal Industry, B.S., M.S., Louisiana State University.
NORWOOD GRAHAM SMITH,
Assistant Professor of English, A.B., M.A., Duke University.
OLIVER MONROE SMITH,
Assistant Professor of Military Science, Major, Infantry, U. S. Army, B.S., University of Georgia.
WILLIAM EDWARD SMITH,
Assistant Professor of Textile Research, B.S., North Carolina State College.
WILLIAM EDWARD SMITH,
Professor of Physical Education, B.S., Western Carolina Teachers College; M.A., University of North Carolina; Ed.D., George Peabody College.
RUFUS HUMMER SNYDER,
Professor of Physics, B.S., Lebanon Valley College; A.M., Columbia University; Ph.D., Ohio State University.
WILLIAM THOMAS SNYDER,
Associate Professor of Mechanical Engineering, B.S.M.E., University of Tennessee; M.S., Ph.D., Northwestern University.
WILLIAM HENRY SONNER,
Instructor of Physical Education, B.S., North Carolina State College; M.Ed., University of North Carolina.
JASON LOY SOX,
Instructor in Mathematics, B.S., M.S., North Carolina State College.
MARVIN LUTHER SPECK,
William Neal Reynolds Distinguished Professor of Animal Industry, B.S., M.S., University of Maryland; Ph.D., Cornell University.

HERBERT E. SPEECE,
Associate Professor of Education and Mathematics, B.A., York College; M.A., Texas Christian University; M.S., North Carolina State College; Ph.D., University of North Carolina.

WILLIAM EDDON SPLINTER,
Research Associate Professor in Agricultural Engineering, B.S., University of Nebraska; M.S., Ph.D., Michigan State College.

DAVID GRIFFIN SPRUILL,
Instructor of Animal Industry, B.S., M.S., North Carolina State College.

HANS HEINRICH STADELMAIER,
Research Professor, Department of Metallurgy, Diplom-Physiker, Technische Hochschule, Stuttgart, Germany.

RAYMOND FRANKLIN STAINBACK,
Associate Professor of Physics, B.S., M.S., University of North Carolina.

WYATT RICHARD STALLINGS,
Instructor in Engineering Graphics, B.S., North Carolina State College.

ALFRED J. STAMM,
Associate Professor of Wood Chemistry, B.S., California Institute of Technology; M.S., Ph.D., University of Wisconsin.

CHARLES JUNIOR STANDISH,
Visiting Associate Professor of Mathematics, A.B., Hamilton College; M.A., Johns Hopkins University; Ph.D., Cornell University.

JOSEPH STANISLAO,
Assistant Professor of Industrial Engineering, B.S.I.E., Texas Technological College; M.S.I.E., Pennsylvania State University.

ROBERT GEORGE DOUGLAS STEEL,
Professor of Experimental Statistics, B.A., B.S., Mount Allison University; M.S., Acadia University, Ph.D., Iowa State College.

ANTHONY PAUL STEMBERGER,
Associate Professor of Agricultural Economics, B.S., M.S., Pennsylvania State University; Ph.D., North Carolina State College.

WILLIAM ARCHIBALD STEPHEN,
Assistant Professor of Entomology, B.S., Ontario Agricultural College; M.S.A., University of Toronto.

STANLEY G. STEPHENS,
William Neal Reynolds Distinguished Professor of Genetics, B.A., Dip. Agri., M.A., Cambridge University; Ph.D., Edinburgh University.

WILLIAM DAMON STEVENSON, JR.,
Professor of Electrical Engineering, B.S.E., Princeton University; B.S.E.E., Carnegie Institute of Technology; M.S., University of Michigan.

HAMILTON ARLO STEWART,
Assistant Director of Research of Agricultural Experiment Station, B.S., M.S., Kansas State College; Ph.D., University of Minnesota.

BILL JUNIOR STINES,
Assistant Statistician of Experimental Statistics, B.S., M.S., North Carolina State College.

EDWARD HOYLE STINSON,
Instructor in Engineering Graphics, B.S., North Carolina State College.

WILLIAM JOHN STOBER,
Instructor in Economics, B.S., Washington and Lee; M.A., Duke University.

ROBERT F. STOOPS,
Research Professor in Engineering Research, B.S., North Carolina State College; M.S., Ph.D., Ohio State University.

E. JACK STORY,
Director, Nuclear Reactor Project, B.S., Southeast Missouri State College; M.S., Vanderbilt University.

CHARLES C. STOTT,
Assistant Professor of Recreation and Park Administration, B.S., North Carolina State College; M.S., Indiana University.

CASWELL RAY STRICKLAND,
Instructor of Textile Research, B.S., North Carolina State College.

DAVID LEWIS STRIDER,
Research Assistant Professor, B.S., M.S., Ph.D., North Carolina State College.

RAIMOND ALDRICH STRUBLE,
Professor of Mathematics, B.S., M.S., Ph.D., University of Notre Dame.

DUNCAN ROBERT STUART,
Associate Professor of Design, University of Oklahoma, Chouinard Art Institute, and Yale University.

WILLIAM CLIFTON STUCKEY, JR.,
Assistant Professor of Textiles, B.S., North Carolina State College.

JACK SUBERMAN,
Director of Summer Sessions and Associate Professor of English, A.B., M.A., University of North Carolina.

CHARLES WILSON SUGGS,
Assistant Professor in Agricultural Engineering, B.S., M.S., Ph.D., North Carolina State College.

MAURICE MOSHE SURDIN,
Visiting Professor of Physics, Licence-es-Sciences, Paris University; Electrical Engineer, Ecole Superieure d'Electricite; Docteur-es-Sciences, Paris University.

PAUL PORTER SUTTON,
Professor of Chemistry, Ph.D., Johns Hopkins University.

LOUIS HALL SWAIN,
Associate Professor of English, B.A., M.A., Duke University.
RALPH CLAY SWANN,
Head of Department and Professor of Chemistry, B.S., Morris Harvey College; Ph.D., Massachusetts Institute of Technology.
ERNST WARNER SWANSON,
Head of Department and Professor of Economics, Ph.B., Ph.D., University of Chicago.
RICHARD J. THOMAS,
Assistant Professor of Wood Technology, B.S., Pennsylvania State University; M.W.T., North Carolina State College.
WALTER EARL THOMAS,
Head, Animal Husbandry Section and Professor of Animal Industry, B.S., M.S., University of Kentucky: Ph.D., Cornell University.
DONALD LORAINE THOMPSON,
Research Associate Professor of Field Crops, B.S., M.S., South Dakota State College; Ph.D., Iowa State University.
OLIVER GEORGE THOMPSON,
Assistant Professor of Economics, B.A., Wofford College; M.A., Wake Forest College.
EDWIN GILBERT THURLOW,
Professor of Landscape Architecture, B.S., North Carolina State College; M.L.A., Harvard University.
FREDERICK LOUIS THURSTONE,
Instructor in Electrical Engineering, B.S., University of North Carolina, M.S., North Carolina State College.
ROBERT LEON THURSTONE,
Instructor in Electrical Engineering, B.S., Illinois Institute of Technology; M.S., University of Missouri.
HAROLD LESLIE TITUS,
Assistant Professor of Modern Languages, B.A., McGill University; LL.B., University of Alabama; M.A., Harvard University; LL.M., New York University.
GEORGE STANFORD TOLLEY,
Professor of Agricultural Economics, B.A., American University; M.A., Ph.D., University of Chicago.
JOHN WILLIAM TOMLIN,
Assistant Professor of Sociology and Anthropology, B.A., M.A., University of Virginia; Ph.D., University of Maryland.
HUSEYIN CAVIT TOPAKOGLU,
Instructor in Mechanical Engineering, M.S.A.E., D.Sc., Technical University of Istanbul.
WILLIAM DOUGLAS TOUSSAINT,
Professor of Agricultural Economics, B.S., North Dakota Agricultural College; M.S., Ph.D., Iowa State College.
SAMUEL B. TOVE,
Professor of Animal Industry, B.S., Cornell University; M.S., Ph.D., University of Wisconsin.
ANASTATIOS CHRISTOS TRIANTAPHYLLOU,
Assistant Geneticist, Athens Superior School of Agriculture; Ph.D., North Carolina State College.
HEDWIG HIRSCHMANN TRIANTAPHYLLOU,
Assistant Professor of Plant Pathology, Ph.D., University of Erlangen, Germany.
ROBERT TINNEN TROXLER,
Assistant Professor of Industrial Arts, B.S., M.I.A., North Carolina State College.
JAMES RICHARD TROYER,
Assistant Professor of Botany, B.A., DePauw University; M.S., Ohio State University; Ph.D., Columbia University.
GEORGE EUGENE TUCKER,
Instructor in Industrial Engineering, B.S.M.E., Alabama Polytechnic Institute.
HULDAH BRINKLEY TURNER,
Instructor in English, A.B., Woman's College, University of North Carolina; M.S., North Carolina State College.
GEORGE FRANKLIN TURNIPSEED,
Research Assistant Professor of Entomology, B.S., Alabama Polytechnic Institute.
LESTER CURTISS ULBERG,
Professor of Animal Industry, B.S., M.S., Ph.D., University of Wisconsin.
NEWTON UNDERWOOD,
Professor of Physics, B.S., Emory University, M.S., Ph.D., Brown University.
VON HARDY UNDERWOOD,
Instructor in Horticulture, B.S., North Carolina State College.
ROBERT PHILLIP UPCHURCH,
Associate Professor of Field Crops, B.S., M.S., North Carolina State College; Ph.D., University of California.
MEHMET ENSAR UYANIK,
Professor of Civil Engineering, B.S.C.E., M.S., Ph.D., University of Illinois.
JAN VAN SCHILFGAARDE,
Research Associate Professor in Agricultural Engineering, B.S., M.S., Ph.D., Iowa State College.
ANDREW PRESTON VARLEY,
Research Assistant of Agricultural Economics, B.S., Iowa State University.
ARTHUR RALPH VERBECK,
Instructor of Textile Research, B.S., North Carolina State College.

FRANCIS JOSEPH VERLINDEN,
Assistant Professor of Experimental Statistics, B.S., Catholic University; M.S., North Carolina State College.
RICHARD JAMES VOLK,
Associate Professor of Soils, B.S., M.S., Purdue University; Ph.D., North Carolina State College.
CHARLES HENRY VOSS,
Instructor in Electrical Engineering, B.S., M.S., Louisiana State University.
HARVEY EDWARD WAHLS,
Assistant Professor of Civil Engineering; B.S.C.E., M.S.C.E., Ph.D., Northwestern University
THOMAS DUDLEY WALLACE,
Assistant Professor of Agricultural Economics and Experimental Statistics, B.S., M.S., Oklahoma State University; Ph.D., University of Chicago.
RICHARD GAITHER WALSER,
Professor of English, B.A., M.A., University of North Carolina.
WILLIAM KERSHAW WALSH,
Research Assistant of Textile Research, B.S., M.S., University of South Carolina.
WILFRED AVES WALTER,
Lecturer in Economics, B.S., U. S. Naval Academy; M.E.A., George Washington University.
ARTHUR WALTER WALTNER,
Professor of Physics, B.A., Bethel College, Kansas; M.S., Kansas State College; Ph.D., University of North Carolina.
JAY RODNEY WALTON,
Instructor in Civil Engineering, B.C.E., North Carolina State College.
SHOU-LING WANG,
Visiting Associate Professor of Engineering Mechanics, B.S., St. John's University; M.S., Yale University; Ph.D., University of Illinois.
THOMAS MARCH WARD,
Instructor in Chemistry, A.B., University of North Carolina.
FREDERICK GAIL WARREN,
Associate Professor of Animal Industry, B.S., Kansas State College; M.S., Ph.D., Pennsylvania State College.
GERALD LEROY WATERMAN,
Assistant Professor of Air Science, B.S., Virginia Military Institute.
RUPERT W. WATKINS,
Research Instructor in Agricultural Engineering, B.S., North Carolina State College.
GEOFFREY STUART WATSON,
Adjunct Professor of Experimental Statistics, B.A., University of Melbourne; Ph.D., North Carolina State College.
GEORGE CARSON WATSON,
Associate Professor of Mathematics, B.A., Randolph-Macon College; M.A., University of Virginia.
EDWARD WALTER WAUGH,
Associate Professor of Architecture, Dipl. in Arch., Edinburgh College of Art, Edinburgh, Scotland.
DAVID STATHEM WEAVER,
Director of Agricultural Extension Service and Professor of Agricultural Engineering, B.S., Ohio State University; M.S., North Carolina State College.
JOHN WILLIS WEAVER, JR.,
Professor of Agricultural Engineering, B.S., Virginia Polytechnic Institute.
BENJAMIN DAVIS WEBB,
Instructor in Engineering Graphics, B.S., North Carolina State College.
STERLING BARG WEED,
Associate Professor of Soils, B.A., Brigham Young University; M.S., Ph.D., North Carolina State College.
JOSEPH ARTHUR WEYBREW,
Professor of Plant Chemistry (Field Crops), B.S., M.S., Kansas State University; Ph.D., University of Wisconsin.
LINDSAY RUSSELL WHICHARD,
Assistant Professor of English, B.A., East Carolina Teachers College; M.A., University of North Carolina.
RAYMOND CYRUS WHITE,
Associate Professor of Chemistry, B.S., Davis and Elkins College; M.S., Ph.D., West Virginia University.
ROBERT BENJAMIN WHITE, JR.,
Instructor in English, B.A., M.A., University of North Carolina.
THOMAS KELLEY WHITE, JR.,
Instructor in Agricultural Economics, B.S., M.S., University of Georgia.
JOHN KERR WHITFIELD,
Associate Professor of Mechanical Engineering, B.M.E., M.S., North Carolina State College.
LARRY ALSTON WHITFORD,
Professor of Botany, B.S., M.S., North Carolina State College; Ph.D., Ohio State University.
BENJAMIN LINCOLN WHITTIER,
Edgar and Emily Hesslein Professor of Fabric Development, School of Textiles, B.A., Williams College.
R. E. WIGGINS,
Instructor in Textiles, B.S., M.S., North Carolina State College.

RUDOLPH WILLARD,
Visiting Professor of Furniture Manufacturing and Management, Ph.B., Yale University.

WILFORD LLOYD WILLEY,
Assistant Professor of Military Science, Lieutenant Colonel, Infantry, U. S. Army, B.S., Montana State College.

CARLOS FROST WILLIAMS,
Professor of Horticulture, B.S., Pennsylvania State College; M.S., North Carolina State College.

JOHN CASWELL WILLIAMS,
Assistant Professor of Field Crops, B.S., M.S., North Carolina State College; Ph.D., Iowa State University.

HARVEY PAGE WILLIAMS,
Professor of Mathematics, B.A., College of William and Mary; M.A., Duke University.

PORTER WILLIAMS, JR.,
Assistant Professor of English, A.B., University of the South; M.A., University of Virginia; B.A., M.A., Cambridge University.

JAMES CLAUDE WILLIAMSON, JR.,
Assistant Director of Research and Extension and Associate Professor of Agricultural Economics, B.S., M.S., North Carolina State College.

JAMES BLAKE WILSON,
Assistant Professor of Mathematics, B.S., University of Florida; M.S., Cornell University; Ph.D., University of Florida.

EDWIN WEEMS WINKLER,
Associate Professor of Electrical Engineering, B.S., Montana State College; M.S., University of North Carolina.

NASH NICKS WINSTEAD,
Associate Professor of Plant Pathology, B.S., M.S., North Carolina State College; Ph.D., University of Wisconsin.

SANFORD RICHARD WINSTON,
Head of Department and Professor of Sociology and Anthropology, B.A., Western Reserve University; Ph.D., University of Minnesota.

LOWELL SHERIDAN WINTON,
Professor of Mathematics, B.S., Grove City College; M.A., Oberlin College; Ph.D., Duke University.

GEORGE HERMAN WISE,
Head, Animal Nutrition Section and William Neal Reynolds Distinguished Professor of Animal Nutrition, B.S., Clemson College; M.S., Ph.D., University of Minnesota.

MILTON BEE WISE,
Assistant Professor of Animal Industry, B.S., Berea College; M.S., North Carolina State College; Ph.D., Cornell University.

EDWARD HEMPSTEAD WISER,
Instructor in Agricultural Engineering, B.S., Iowa State College; M.S., North Carolina State College.

WILLIE GARLAND WOLTZ,
Professor of Soils, B.S., North Carolina State College; Ph.D., Cornell University.

HENRY KUO-CHUAN WOO,
Instructor in Textile Research, B.S., North Carolina State College.

THOMAS WILMONT WOOD,
Professor of Economics, B.S., M.A., University of Alabama; Ph.D., University of North Carolina.

JAMES WOODBURN,
Professor of Mechanical Engineering, B.S.M.E., Purdue; Dr. Engr., Johns Hopkins University.

ARTHUR JOSEPH WOODBURY,
Assistant Professor of Textile Research.

WILLIAM WALTON WOODHOUSE, JR.,
Professor of Soils, B.S., M.S., North Carolina State College; Ph.D., Cornell University.

SCOTT WRIGHT,
Research Instructor in Agricultural Engineering, B.S., Clemson Agricultural College.

THOMAS J. WRIGHT,
Ore Dressing Engineer, B.S., Montana School of Mines.

ROBERT BAKER WYNNE,
Associate Professor of English, B.A., M.A., College of William and Mary.

WILLY G. YAMAMOTO,
Research Engineer, B.S., North Carolina State College.

JAMES TSING-SEN YEN,
Assistant Professor of Aeronautical Engineering, B.S., Taiwan College of Engineering; M.S.M.E., Ph.D., University of Minnesota.

DAVID A. YOUNG, JR.
Associate Professor of Entomology, B.A., University of Louisville; M.S., Cornell University; Ph.D., University of Kansas.

JAMES NEAL YOUNG,
Assistant Professor of Rural Sociology, B.S., Clemson College; M.S., Ph.D., University of Kentucky.

TALMAGE BRIAN YOUNG,
Associate Professor of Industrial Arts, B.S., Berry College; B.S., University of Florida; M.A. Ed., Ed.D., University of Florida.

SANFORD EUGENE YOUNTS,
In Charge, Soils Instruction and Associate Professor of Soils, B.S., M.S., North Carolina State College; Ph.D., Cornell University.

BRUCE J. ZOBEL,
Professor of Forest Genetics, B.S., M.F., Ph.D., University of California.

EMERITI FACULTY

BARTHOLOMEW BRANDNER BRANDT,
Professor Emeritus of Zoology, B.S., Mississippi State College; A.M., Ph.D., Duke University.

WILLIAM STALEY BRIDGES,
Associate Professor Emeritus of Mechanical Engineering, B.E., M.S., North Carolina State College.

HERMON BURKE BRIGGS,
Professor Emeritus of Engineering Drawing and Descriptive Geometry, B.E., M.E., North Carolina State College.

PERLEY FLOYD BROOKENS,
Associate Professor Emeritus of Economics, B.A., University of South Dakota; Ph.D., University of Maryland.

BENJAMIN FRANKLIN BROWN,
Dean Emeritus of the Basic Division, B.S., Northwestern University.

THOMAS EVERETTE BROWNE,
Director Emeritus of the Division of Teacher Education, B.A., Wake Forest College; M.A., Columbia University.

JAMES KIRK COGGIN,
Professor Emeritus of Agricultural Education, B.S., North Carolina State College; M.S., Cornell University.

GERTRUDE MARY COX,
Professor Emeritus of Experimental Statistics, B.S., M.S., Iowa State College; Sc.D. (Hon.), Iowa State College.

HILBERT ADAM FISHER,
Professor Emeritus of Mathematics, M.S., North Carolina State College; Graduate, United States Naval Academy; Graduate, United States Submarine School; LL.D., Lenoir-Rhyne College.

GARNET WOLSEY FORSTER,
Professor Emeritus of Agricultural Economics, B.S., Cornell University; M.S., Ph.D., University of Wisconsin.

RAYMOND SPIVEY FOURAKER,
Professor Emeritus of Electrical Engineering, B.S., A. & M. College of Texas; M.S., University of Texas.

BENTLEY BALL FULTON,
Professor Emeritus of Entomology, B.A., Ohio State University; M.S., Chicago University; Ph.D., Iowa State College.

CLAUDE DELBERT GRINNELLS,
Professor Emeritus of Animal Industry, B.S., M.S., University of Minnesota; D.V.S., Cornell University.

JOHN THOMAS HILTON,
Professor Emeritus of Textiles, Diploma, Bradford Durfee Textile School; B.S., M.S., North Carolina State College.

LAWRENCE EARLE HINKLE,
Professor Emeritus of Modern Languages, B.A., University of Colorado; M.A., Columbia University; D.S. es L., Dijon University.

ELMER GEORGE HOEFER,
Professor Emeritus of Mechanical Engineering, B.S., M.E., University of Wisconsin.

JULIUS VALENTINE HOFMANN,
Director Emeritus of the Division of Forestry, B.S.F., M.F., Ph.D., University of Minnesota.

EARL HENRY HOSTETLER,
Professor Emeritus of Animal Industry, B.S.A., Kansas State Agricultural College; M.Agri., M.S., North Carolina State College.

WALTER EDWARD JORDAN,
Associate Professor Emeritus of Chemistry, B.S., M.S., Wake Forest College; M.E., North Carolina State College.

CLAUDE MILTON LAMBE,
Assistant Professor Emeritus of Civil Engineering; B.E., North Carolina State College.

WILLIAM D. LEE,
Associate Professor Emeritus of Agronomy, B.S., North Carolina State College.

SAMUEL GEORGE LEHMAN,
Professor Emeritus of Plant Pathology, B.S., Ohio University; M.S., North Carolina State College; Ph.D., Washington University.

MALCOLM LEWIS,
Instructor Emeritus in Mechanical Engineering, B.S., Massachusetts Institute of Technology.

CLARENCE EARL LIBBY,
Reuben B. Robertson Professor Emeritus of Pulp and Paper Technology, B.S., Ch.E., University of Maine.

CARROLL LAMB MANN,
Professor Emeritus of Civil Engineering, B.S.C.E., C.E., North Carolina State College.

THOMAS JACKSON MARTIN, JR.,
Assistant Professor Emeritus of Mechanical Engineering, B.E., M.S., North Carolina State College.

JOHN FLETCHER MILLER,
Professor Emeritus of Physical Education, B.Pd., Central Missouri Teachers' College; B.P.E., Springfield College.

RUEBEN O. MOEN,
Professor Emeritus of Economics, B.A., M.A., Ph.D., State University of Iowa.

THOMAS LEWIS NASH,
Instructor Emeritus in Mechanical Engineering, B.S., United States Naval Academy.
JEHU DEWITT PAULSON,
Professor Emeritus of Drawing, B.F.A., Yale University.
ROBERT JAMES PEARSALL,
Assistant Professor Emeritus of Electrical Engineering, B.E., North Carolina State College.
GEORGE HOWARD SATTERFIELD,
Professor Emeritus of Chemistry, A.B., M.A., Duke University; B.S., North Carolina State College.
IRA OBED SCHAUB,
Director Emeritus of the Agricultural Extension Service, B.S., North Carolina State College; D.Sc. (Hon.), Clemson College.
ROBERT SCHMIDT,
Associate Professor Emeritus of Horticulture, B.S., Rutgers University.
FRANCIS WEBBER SHERWOOD,
Professor Emeritus of Animal Industry, B.S., M.S., North Carolina State College; Ph.D., Cornell University.
MERLE FRANKLIN SHOWALTER,
Associate Professor Emeritus of Chemistry, A.B., Indiana University, M.S., Purdue University.
JASPER LEONIDAS STUCKEY,
Professor Emeritus of Geology, B.A., M.A., University of North Carolina; Ph.D., Cornell University.
LILLIAN LEE VAUGHAN,
Professor Emeritus of Mechanical Engineering, B.S., North Carolina State College; M.E., Columbia University.
NATHANIEL WARREN WELDON,
Assistant Professor Emeritus of Agricultural Engineering, B.S., North Carolina State College.
BERTRAM WHITTIER WELLS,
Professor Emeritus of Botany, A.B., M.A., Ohio State University; Ph.D., University of Chicago.
THOMAS LESLIE WILSON,
Professor Emeritus of English, B.A., Catawba College; M.A., Wofford College.
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Professor Emeritus of Forest Utilization, B.A., M.F., Harvard University.

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B.S., North Carolina State College

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Golf: ALBERT MICHAELS

Swimming: WILLIS R. CASEY

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Tennis: JOHN KENFIELD

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A.B., Randolph-Macon Woman's College; B.S. in L.S., University of North Carolina

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A.B., Davis and Elkins; B.S. in L.S., University of North Carolina

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B.A., University of Iowa; A.M. in L.S., University of Denver

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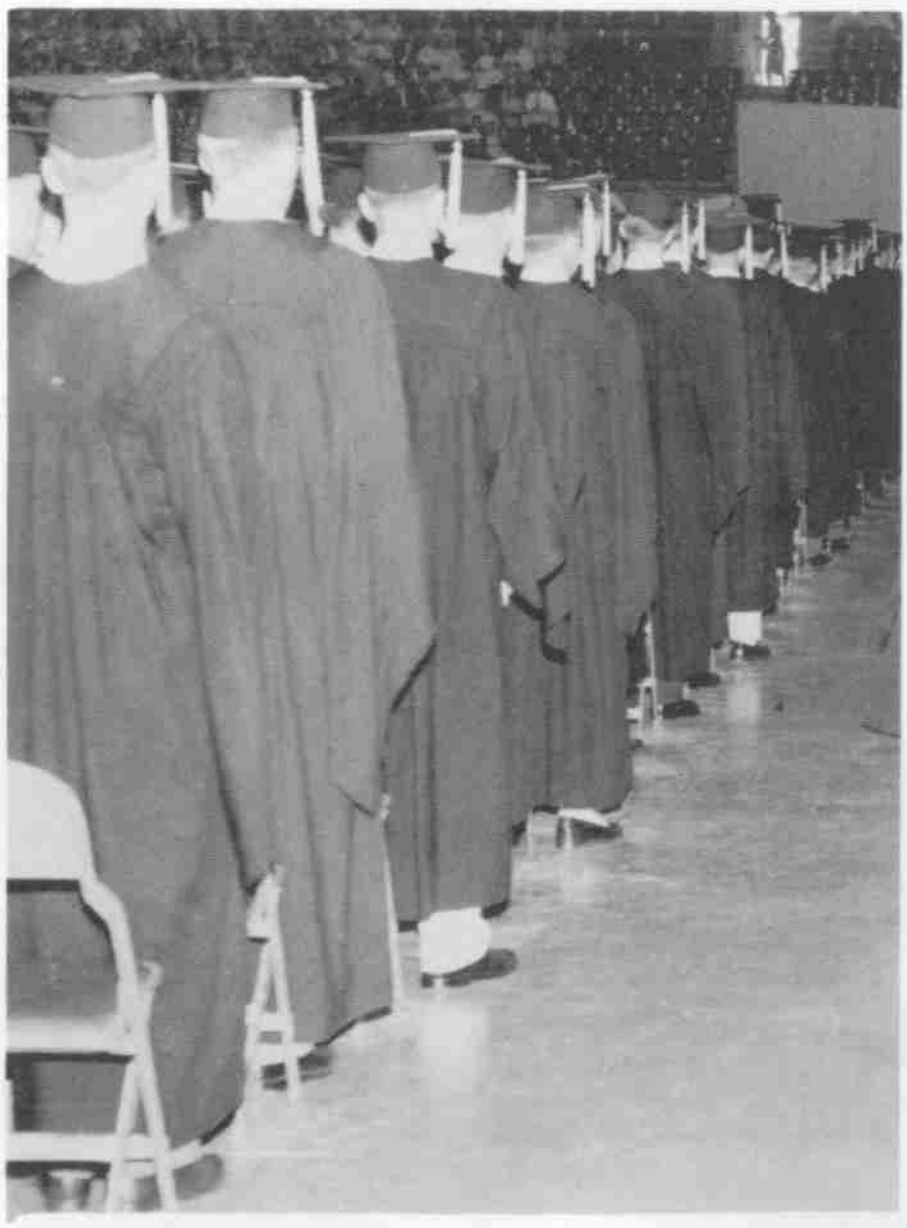
Registration . . .

REGISTRATION is held in the fall at William Neal Reynolds Coliseum.



. . . Graduation

GRADUATION exercises amid much fanfare also take place in the Coliseum.