STATE COLLEGE RECORD

NORTH CAROLINA

STATE COLLEGE

GENERAL CATALOG

$1962 \cdot 1964$



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STATE COLLEGE RECORD

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NORTH CAROLINA



GENERAL CATALOG

Catalog Issue 1962-1964

Announcements for Sessions 1962-1963, 1963-1964

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING ESTABLISHED 1887

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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 include:

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 Frederick Henry Weaver, A.B., M.A., Secretary

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 overall 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.

The Secretary of the University performs general administrative duties and is the principal liaison officer with the Board of Trustees.

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

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

ACADEMIC AFFAIRS

Harry C. Kelly, B.S., M.S., Ph.D., Dean of the Faculty, 110 Holladay Hall

SCHOOL OF AGRICULTURE

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SCHOOL OF DESIGN

Henry L. Kamphoefner, Dean, 200 Brooks Hall

SCHOOL OF EDUCATION

J. Bryant Kirkland, Dean, 119 Tompkins Hall

SCHOOL OF ENGINEERING

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SCHOOL OF FORESTRY

Richard J. Preston, Dean, 160 Kilgore Hall

SCHOOL OF GENERAL STUDIES

Fred V. Cahill, Jr., Dean, 162 Harrelson Hall

SCHOOL OF PHYSICAL SCIENCES AND APPLIED MATHEMATICS

Arthur Clayton Menius, Jr., Dean, 118 Riddick Building Carey G. Mumford, Assistant to the Dean, 119 Riddick Building

SCHOOL OF TEXTILES

Malcolm E. Campbell, Dean, 101 Nelson Building

COLLEGE EXTENSION

Edward W. Ruggles, Director, College Extension Division, 118 1911 Building

GRADUATE SCHOOL

Walter J. Peterson, Dean, 145 Gardner Hall

LIBRARY

Harlan C. Brown, Librarian, 132 D. H. Hill Library

WUNC-TV

George L. Hall, Director of Television

STUDENT AFFAIRS

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DEPARTMENT OF COUNSELING

Lyle B. Rogers, Director, 201 Holladay Hall Kingston Johns, Jr., Financial Aid Officer, 207 Holladay Hall

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J. J. Combs, College Physician, Clark Infirmary

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DEVELOPMENT AFFAIRS

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BUSINESS AFFAIRS

J. G. Vann, Business Manager, 105 Holladay Hall W. L. Turner, Assistant Business Manager, Holladay Hall John D. Wright, Assistant Budget Officer, "B" Holladay Hall John C. Williams, Purchasing Agent, 107 1911 Building J. McCree Smith, Director, Maintenance and Operations, College Engineer, Morris Building Fred V. Coleman, Slater Food Service, Leazar Dining Hall L. L. Ivey, Manager of Student Stores, SSS Building

Calendar

Fall Semester, 1962

Sept. 10	Monday	General faculty meeting.
Sept. 10-12	Monday-Wednesday	New student orientation.
Sept. 13	Thursday	Freshman registration.
Sept. 14	Friday	Upperclassman registration. Late registration fee
		of \$5.00 payable by all who register after Sept. 14.
Sept. 14-15	Friday-Saturday	Continuation of new student orientation.
Sept. 17	Monday	Classes begin at 8:00 a.m.
Sept. 21	Friday	Last day for registration. Last day for refund less
		\$5.00 registration fee.
Sept. 28	Friday	Last day to add a course.
Oct. 5	Friday	Last day to drop a course without failure.
Nov. 10	Saturday	Mid-term reports.
Nov. 21	Wednesday	Thanksgiving holidays begin at 1:00 p.m.
Nov. 26	Monday	Classwork resumes at 8:00 a.m.
Nov. 27	Tuesday	Last day to withdraw from school without failures.
Dec. 19	Wednesday	Christmas holidays begin at 6:00 p.m.
Jan. 3, 1963	Thursday	Classwork resumes at 8:00 a.m.
Jan. 16	Wednesday	Last day of classes.
Jan. 17	Thursday	Reading day.
Jan. 18-25	Friday-Friday	Final examinations.

Spring Semester, 1963

Jan. 31	Thursday	Orientation of new students.
Feb. 1	Friday	Registration. Late registration fee of \$5.00 payable
		by all who register after Feb. 1.
Feb. 4	Monday	Classes begin at 8:00 a.m.
Feb. 8	Friday	Last day to register. Last day for refund less \$5.00
		registration fee.
Feb. 15	Friday	Last day to add a course.
Feb. 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 22	Wednesday	Last day of classes.
May 23	Thursday	Reading day.
May 24-31	Friday-Friday	Final examinations.
June 1	Saturday	Commencement.

Summer Sessions, 1963

First Session

June	10	Monday	New student orientation.
June	11	Tuesday	Registration and fee payment for regular session.
			Late registration fee of \$5.00 payable by all regis-
			tering after June 11.
June	12	Wednesday	First day of classes.
June	17	Monday	Last day for registration. Last day to withdraw with
			refund and last day to drop any course with refund.
June	21	Friday	Last day to drop courses without failure and last
			day to withdraw without failure.

July 4-5 July 18 July 19	Thursday-Friday Thursday Friday	Holidays. Last day of classes. Final examinations.
Second Session		
Tulv 19	Friday	New student orientation.
July 22	Monday	Registration and fee payment. Late registration fee of \$5.00 payable by all registering after July 22.
July 23	Tuesday	First day of classes.
July 29	Monday	Last day for registration. Last day to withdraw with refund and last day to drop any course with refund.
Aug. 2	Friday	Last day to drop courses without failure and last day to withdraw without failure.
Aug. 23	Friday	Last day of classes.
Aug. 24	Saturday	Final examinations.

Fall Semester, 1963

Sept. 9	Monday	General faculty meeting.
Sept. 9-11	Monday-Wednesday	New student orientation.
Sept. 12	Thursday	Freshman registration.
Sept. 13	Friday	Upperclassman registration. Late registration fee
*	-11	of \$5.00 payable by all who register after Sept. 13.
Sept. 13-14	Friday-Saturday	Continuation of freshman orientation.
Sept. 16	Monday	Classes begin at 8:00 a.m.
Sept. 20	Friday	Last day for registration. Last day to withdraw
		with refund less \$5.00 registration fee.
Sept. 27	Friday	Last day to add a course.
Oct. 4	Friday	Last day to drop a course without failure.
Nov. 9	Saturday	Mid-term reports.
Nov. 27	Wednesday	Thanksgiving holidays begin at 1:00 p.m.
Dec. 2	Monday	Classwork resumes at 8:00 a.m.
Dec. 3	Tuesday	Last day to withdraw from school without failures.
Dec. 19	Thursday	Christmas holidays begin at 6:00 p.m.
Jan. 6, 1964	Monday	Classwork resumes at 8:00 a.m.
Jan. 15	Wednesday	Last day of classes.
Jan. 16	Thursday	Reading day.
Jan. 17-24	Friday-Friday	Final examinations.

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Spring Semester, 1964

Jan. 30	Thursday	New student orientation.
Jan. 31	Friday	Registration. Late registration fee of \$5.00 payable
	аў. 1	by all who register after Jan. 31.
Feb. 3	Monday	Classes begin at 8:00 a.m.
Feb. 7	Friday	Last day to register. Last day to withdraw with
		refund less \$5.00 registration fee.
Feb. 14	Friday	Last day to add a course.
Feb. 21	Friday	Last day to drop a course without failure.
March 21	Saturday	Mid-term reports.
March 25	Wednesday	Easter holidays begin at 6:00 p.m.
March 30	Tuesday	Classwork resumes at 8:00 a.m.
April 6	Monday	Last day for withdrawing from school without
	,	failures.
May 20	Wednesday	Last day of classes.
May 21	Thursday	Reading day.
May 22-29	Friday-Friday	Final examinations.
May 30	Saturday	Commencement.



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GENERAL INFORMATION

History

North Carolina State College, the State's technological institution of higher learning and Land-Grant College, was founded by legislative act on March 7, 1887. Prior to this time, the Morrill Act of 1862 authorized the use of public land or its equivalent in land script for the creation of an agricultural and mechanical college in each State. North Carolina did not establish such a specialized institution until State College was founded.

First named the North Carolina College of Agriculture and Mechanic Arts, the institution began operations with 45 students and six teachers on October 3, 1889. The first president was Colonel Alexander Q. Holladay for whom the first building was later named.

The College's name was changed to the North Carolina State College of Agriculture and Engineering in 1917. In 1931, the North Carolina General Assembly formed the Consolidated University of North Carolina, embracing the University of North Carolina in Chapel Hill, the North Carolina State College of Agriculture and Engineering in Raleigh, and the Woman's College in Greensboro.

After World War II, returning service men nearly tripled any previous State College enrollment. Today, State College is one of the best-housed and best-equipped technological institutions of higher learning in the nation. Through its 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. At the beginning of the 1961 fall semester the student body numbered more than 7,000 young men and women with 660 members of the teaching staff and a total staff of nearly 3,000 persons including administrative, extension, and research personnel across the State.

Campus

Adjoining the central North Carolina State College 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 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 College's physical plant is valued at over \$50,000,000 with a multimillion dollar construction program now in progress. The College has 73 major buildings.

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

Harrelson Hall . . . circular classroom building, can seat 3,500 students at a time in 77 classrooms which can hold 18 to 189 students.

William D. Carmichael Gymnasium . . . valued at approximately \$2,600,-000, features modern facilities.

Bragaw Dormitory . . . first occupied in 1958, built at a cost of \$2,000,000, all corridors are on the outside.

Student Supply Store . . . ultra-modern structure, offers reading material ranging from 25-cent paperbacks to the latest engineering encyclopedia.

Memorial Tower . . . a 116-foot campanile of white Mount Airy granite, is a monument to the State College men who lost their lives in World War I.

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

William Neal Reynolds Coliseum . . . one of the country's largest indoor stadiums, seating 12,500 for sports attractions and more for stage events.

Erdahl-Cloyd Union . . . one of the nation's most modern student-faculty activities centers.

McKimmon Village . . . a 300-unit married student housing center.

Services

State College serves the people of North Carolina in six main ways. The citizenry is reached through: resident instruction, off-campus instruction in College Extension Division courses, off-campus Agricultural Extension Service demonstrations, special instruction in technical institutes, industrial and agricultural research-both basic and applied, and direct contact with the home by means of radio and television.

Summary of Enrollment

The enrollment at North Carolina State College for the 1961 fall semester totaled 7,117 students, 6,944 men and 173 women.

Enrollment by Classification Sophomores _____1348 Seniors _____1339 5th Year Professionals _____ 35 Agricultural Institute _____ 212 Special and Auditors _____ 32

7117

Enrollment by Schools	
Agriculture	
Design	
Education	577
Engineering	
Forestry	413
Physical Sciences and Applied	
Mathematics	554
Textiles	
General Studies (Auditors	
and Unclassified)	
Graduate (Unclassified)	
Agricultural Institute	
	7117

Admission Requirements

To be admitted to a regular session of North Carolina State College, an applicant must be of good moral character and present evidence of acceptable preparation for work at the college level. Every applicant must complete an application form which may be obtained from:

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

The completed form should be returned to the above address. Applications for admission for both the fall and spring semesters will be considered as soon as they are received. The deadline for submitting fall semester applications is September 1; for the spring semester, January 1. A \$10 fee should accompany all applications for admissions. This fee will be refunded to those who are denied admission, or applied to the college fees of those who are cleared for admission and who subsequently register for the semester for which application was made.

Admission to Freshman Standing

To be admitted as a freshman, the applicant should be a graduate of an accredited high school. It is possible for graduates of non-accredited high schools and holders of high school equivalency certificates to have individual consideration for admission. Applicants must take the Scholastic Aptitude Test of the College Entrance Examination Board and have the scores submitted to the Office of Admissions. These scores, together with the high school record, will be considered in determining admissibility. The high school record should be submitted along with the application and must show at least 16 units of completed high school work which should be distributed as follows:

- 4 units of English (see English paragraph below)
- 2 units of algebra; 1 unit of plane geometry (see mathematics paragraph below)
- 1 unit of Unites States history (see paragraph below)
- 2 units of natural science

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

Students who show lack of proficiency in English as indicated by scores made on the verbal section of the Scholastic Aptitude Test, are advised to take a special non-credit course in English composition before taking the

regular credit courses 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 plan their preparatory work. Students with high scores on the verbal section of the Scholastic Aptitude Test are invited to participate in an accelerated English program. Foreign students lacking a satisfactory command of English are required to take courses in English for foreign students until they are sufficiently familiar with the language to proceed with regular courses in English.

Mathematics

The minimum entrance requirements in mathematics for all curricula include two units of basic algebra and one unit of plane geometry.

During the academic year, 1962-63, one-half unit of solid geometry is required for entrance in Agricultural Engineering, the School of Design, the School of Engineering, the School of Physical Sciences and Applied Mathematics and Mathematics Education. Students will be admitted without a deficiency in solid geometry if they have had four years of high school mathematics which included algebra, geometry, and trigonometry and if they have made satisfactory scores on the mathematics section of the Scholastic Aptitude Test. A non-credit course in solid geometry may be taken prior to admission or while in residence through the Extension Division to remove a deficiency in this subject.

Beginning in the fall of 1963 students entering in Agricultural Engineering, Architecture, Product Design, all curricula of the School of Engineering (except Furniture Manufacturing and Management), the School of Physical Sciences and Applied Mathematics, and Mathematics Education are urged to present four units of mathematics which include advanced algebra and trigonometry. Students entering these curricula will not be required to take Mathematics 101, College Algebra and Trigonometry, if they have met this standard. Students entering in these curricula without this four year high school mathematics sequence will be admitted with a mathematics deficiency which may delay their regular progress; such students will be required to take Mathematics 101 during their freshman year or during either summer session preceding their freshman year. Students entering in Landscape Architecture and Furniture Manufacturing and Management will continue with solid geometry as a requirement. All other curricula will continue to require only the two units in algebra and the unit in plane geometry as entrance requirements in mathematics. No student will be admitted to any curriculum with deficiencies in the basic two units of algebra and the one unit in plane geometry.

History

Students may make up a deficiency in United States history after enrollment and receive college credit for the course. Foreign students are required to complete a course in United States history before graduation. Applicants with at least three years of high school work who present satisfactory scores on the regular Scholastic Aptitude Test of the College Entrance Examination Board and a satisfactory rank in class may be admitted, subject to the completion of the course requirements stated above and any other requirements for high school graduation.

Applicants from other states of the United States must meet the preceding requirements and, in addition, must be recommended by the school in which enrollment is sought.

Applicants from foreign countries are not required to take the Scholastic Aptitude Test. The previous school records of foreign students provide the primary basis for their admission. In addition, a foreign student must show proficiency in the English language and submit a statement of financial responsibility.

Admission of Transfer Students

Transfer students with less than 29 semester hours of transfer credit must meet the admissions criteria for entering freshmen as outlined above. To be admitted as a nonfreshman transfer student, the applicant must have acquired at least 29 semester hours of college work (the equivalent of sophomore standing) at an accredited institution with credit for at least one semester each of college algebra and English included. The applications of transfer students from non-accredited institutions will be reviewed by the Admissions Committee.

All applicants for transfer must have an overall "C" average on work taken at other institutions and must be eligible to return to the last institution regularly attended. Students whose records show below "C" average work cannot be admitted unless such admission is approved by the Admissions Committee.

If the prospective transfer student's record shows an overall "C" average or better, it will be evaluated by the dean or director of instruction of the school in which the student wishes to enroll. A \$2.00 transcript evaluation fee, payable to North Carolina State College, is charged for this service. Evaluation by the school will be final. No previously earned credit can be disregarded in evaluating a student's record.

Students eligible to continue at other units of the Consolidated University may transfer even though they do not have an overall "C" average. Students transferring between units of the Consolidated University will receive credit and honor points for all courses taken at the former unit.

All transfer students must have official transcripts sent to the Office of Admissions directly from each other college attended. Failure of the student to submit a transcript from all colleges previously attended may result in his dismissal.

Admission of Unclassified Students

An unclassified student is one who is earning college credit but is not working toward a degree at North Carolina State College. 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 admissions requirements as regular students. 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.

Admission of Special Students

Admission to the College in this category requires the recommendation of the dean of the school concerned. The usual college admission requirements may be waived for mature students, but regular rules of scholarship will apply after admission. If a special student wishes to change to regular status at a later date he must meet the same admission requirements as regular students. The special student may not represent the College in any intercollegiate contests or become a member of any fraternity—professional or social.

Admission as an Auditor

Admission as an auditor requires the permission of the instructor and

the department head. The participation of auditors in class discussion or in tests or examinations is optional with the instructor. Auditors receive no college credit; they are expected, however, to attend classes regularly.

Readmission of Former North Carolina State College Students

To be readmitted after having withdrawn from the College or having been out of school for one or more semesters, the student must be academically eligible to return and should apply to the Office of Admissions and Registration for readmission at least 30 days prior to the date of desired enrollment.

Admission of Graduate Students

All students working toward advanced degrees are enrolled in the Graduate School. Procedures and policies governing graduate admission are outlined in a special catalog issued by the Graduate 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

- \boldsymbol{B} Good
- \boldsymbol{C} Average
- DPassing
- F, FA, FDFailing
- AU Audit
- ABAbsent from examination

4 quality points for each credit hour. 3 quality points for each credit hour. 2 quality points for each credit hour. 1 quality point for each credit hour. 0 quality point for each credit hour. 0 credit hours and 0 quality points

- INIncomplete
- S Satisfactory (for graduate students)
- Unsatisfactory (for graduate students) \boldsymbol{U}
- Passed (for graduate students) \boldsymbol{P}
- D^* Failure removed by re-examination (for seniors only)
- HIndicates work of outstanding quality (for Chapel Hill graduate students)
- PIndicates clearly satisfactory work (for Chapel Hill graduate students)
- Indicates low passing work (for Chapel Hill graduate students) L

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 his work, not caused by the student's own negligence. An incomplete 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 the final examination. If an absence from examination is excused, the student must arrange to 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 the course 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 a 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 grade will be counted. 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 administering such a re-examination.

Course Repeat Rule

Any undergraduate student will be permitted to substitute the second grade made on any course for the first grade earned on that course, until he has repeated a total of 15 hours of course work. If a course is taken a third time, both the second and third grades will be counted. In computing the cumulative scholastic average for a student who has repeated a course (within the 15-hour and one-repeat-per-course limitations), the hours and quality points earned the first time will be omitted from the computation and only the second earned grade, whether an F or higher, will count.

Scholarship Standards

Semester Rule

Any student carrying 14 or more semester hours must pass at least 6 hours of work during the first semester in which he is registered at State College, and 8 hours each semester thereafter. A student carrying less than 14 hours must pass at least half of the work rostered in order to continue.

1.5 and 2.0 Average Rule

Students who have earned 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 will 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.

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 Requirements

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 a cumulative 2.0 average.

Students who have satisfactorily completed the requirements for more than one bachelor's degree may, upon the recommendation of their deans and payment of a double diploma fee, be awarded two bachelor's degrees at the same or at different commencement exercises.

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

To be graduated with honors, a student must have attained a 3.0 quality point average on all semester hours of work taken 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 of credit before being eligible for a degree. Residence at either of the other two units of the University of North Carolina satisfies the residence requirement 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 next classification. At the present time students are classified at the beginning of the fall semester and at no other time. The required number of hours for each classification is as follows: Freshman Sophomore Junior Senior 1-28 semester hours of earned credit
29-62 semester hours of earned credit
63-96 semester hours of earned credit
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 number of 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 the required course in freshman English and the required freshman and sophomore courses in physical education every semester until these courses are passed satisfactorily.

Withdrawals from the College

Students who wish 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 wishes to withdraw should report to the Counseling Center in Holladay Hall to initiate the official withdrawal process. 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 or 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 sixweek 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 work load requirements of the appropriate federal agency.

Opportunities for Superior Students

Since it has often been found that gifted students do their best work when confronted with programs adapted to their abilities, North Carolina State College offers challenging opportunities to such individuals through superior student programs in mathematics, physics, chemistry, and English; honors programs for upperclassmen in engineering, physical sciences and applied mathematics, forestry, and agriculture; and a program in undergraduate research participation. The College also allows well-prepared students to seek advanced placement by means of qualifying examinations. A brochure describing these programs may be obtained by writing to the director of admissions.

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 director of admissions.

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 undergraduate, 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 during the registration period. All charges are subject to change without notice, but the charges in effect currently are as follows:

Out of State

Regular Undergraduate Students

			Oui-oj-siate		
Schools	In-State Students		Students		
	Fall Semester	Spring Semeste r	Fall Semester	Spring Semester	
Agriculture	\$161.50	\$154.50	\$374.00	\$367.00	
Design	160.50	154.50	373.00	367.00	
Education	161.50	154.50	374.00	367.00	
Engineering	160.50	154.50	373.00	367.00	
Forestry	170.50	154.50*	383.00	367.00*	
General Studies	158.50	152.50	371.00	365.00	
Physical Sciences and					
Applied Mathematics	160.50	154.50	373.00	367.00	
Textiles	160.50	154.50	373.00	367.00	

* Add \$10.00 if not registered in fall semester.

Late Registration

Registration schedules are set for specific days, and certain definite procedures are outlined. A student has not completed registration until all of 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.

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.

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.

Unclassified Students

A student registering for course work as an unclassified student but requesting graduate credit will be charged the regular graduate student rate.

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 of cap and gown, is charged candidates for the baccalaureate degree during the last semester before the degree is awarded.

Deposits

(a) As partial security for library books, laboratory equipment, etc., a general deposit of \$20 must be paid by regularly enrolled undergraduate and graduate 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 lockers, etc. In such instances departmental regulations will apply.

Professional Students in Engineering

Students in the various fifth-year professional curricula will be charged on the same basis as undergraduate 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 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 a tuition fee of \$15 and a \$5.00 registration 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 Housing Rental Office. 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 as long as space is available, in the order in which payment of rent is received. Individual preferences as to location of room and/or choice of roommate will be complied with as far as possible. All reservations are subject to published dormitory rules and regulations.

Male freshman students are required to live in the College dormitories unless they are married, veterans, or living with parents or relatives. Each of these freshmen must make a written application to the director of student housing for permission to live outside of the dormitories.

Married Student Housing

College-owned apartments for married students rent for the following amounts:

Efficiency apartment	\$43.00 per month
One-bedroom apartment	57.50 per month
Two-bedroom apartment	69.00 per month

Linen Rental Service

Linen Rental Service is available upon request at the rate of \$10 per semester, and includes a weekly issue of two sheets, one pillow case, and three bath towels. Students living in dormitories may submit their application along with remittance at the time of room rent payment. Students living off campus may make application at the Business Office in Holladay Hall or at the College Laundry.

Board

Meals are served cafeteria style, and the cost depends upon the individual student. Average cost is 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 is \$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 costs. Other items are variable with the individual student.)

Tuition	First	Semester	Second	Semester		Year	
(Non-resident students							
add \$212.50 per semester)	\$	87.50	\$	87.50	\$	175.00	
Other college fees (may be							
slightly higher or lower,							
depending upon school)		73.00		67.00		140.00	
General deposit (paid only		ан.					
upon first enrollment)		20.00				20.00	
Dormitory room		85.00		85.00		170.00	
Linen service (optional)		10.00		10.00		20.00	
Board	9	250.00-300.00	5	250.00-300.00		500.00-600.00	
Books and supplies		50.00-100.00		25.00		75.00-125.00	
Other personal expenses and							
incidentals		100.00-150.00		100.00-150.00		200.00-300.00	
Total (N. C. residents)	\$	675.50-825.50		624.50-724.50	\$1	300.00-1550.00	
Total (non-residents)	\$8	88.00-1038.00	\$	837.00-937.00	\$ 1′	725.00-1975.00	

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:

Housing Rental Office Leazar Hall North Carolina State College Raleigh, North Carolina

Linen Rental

No refunds or credits will be made to a student for those weeks he fails to use the linen rental service. The exception to this case is the student who officially withdraws from college. He will be refunded for the unused service at the rate of fifty cents (.50) per week provided he returns the final issue of linen to the College Laundry.

General Deposit

Miscellaneous charges for laboratory breakage, traffic fines, dormitory and property repair charges, military property charges, physical education equipment and property charges, and all other miscellaneous charges when less than \$15 will be deducted from the general deposit of \$20, as incurred throughout the year. The \$20 general deposit must be rebuilt to the \$20 level by the student at the beginning of the fall semester before the completion of registration or whenever the deposit has been depleted to the \$5.00 level.

The general deposit of \$20 or the remaining balance is refunded when a student has completed the requirements for a degree or has dropped out of school permanently. 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 the date the application is received.

Refund Committee

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

Student Activities and Services

State College makes every effort to provide the student with surroundings which are pleasant and conducive to intellectual growth. Respecting the student as an individual, the College assures him the maximum of personal liberty within the limits necessary for orderly progression of class work. 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 may serve him well in 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 selfgoverning 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 campuswide 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 organizations 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

Eighteen 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 national social sorority, Sigma Kappa, which recently established a chapter here.

Student Publications

A variety of publications, both general and school-sponsored, are 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

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.

The Technician

The Technician is a student newspaper, issued three times a week and delivered to the dormitories and fraternity houses. Students living offcampus pick up their copies of the newspaper from special Technician boxes located at Watauga Hall, the Coliseum, and at the main desk in the College Union. The Technician serves as a forum for student expression as well as a medium for news of particular interest to State College students.

The Student Broadcasting System

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 Tower

Each student receives a copy of *The Tower*, the college handbook, which contains detailed information about student regulations, organizations, and activities.

Other Publications

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 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 is divided into three divisions: Dormitory, Fraternity, and Open. Thirteen sports are offered in the dormitory and fraternity divisions, and four sports plus special events in the open division.

Sports offered in the intramural program are correlated with those taught in the required programs of physical education. Instruction in these sports is given in the classes and opportunity for competition is provided in the intramural program. An Intramural Advisory Board, composed of student representatives and one physical education staff member, determines the policies to be administered by the intramural director.

The intramural facilities, both indoor and outdoor, are excellent. The intramural playing fields, adjacent to the gymnasium, provide space for 10 softball or 10 football games to be played simultaneously. Twenty tennis courts are available for tennis and construction of additional courts is being considered.

The gymnasium has 10 four-wall handball courts, six squash courts, and separate rooms for boxing, wrestling, golf, correctives and weightlifting. 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 greater than the size of a regulation basketball court.

The swimming pool, located in an adjoining building, is 25 meters by 25 yards and has 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 recommended, however, by the Athletics Council which is composed of faculty, students, and alumni. The policies are in full accord with the Atlantic Coast Conference and N. C. A. A. 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, the University of South Carolina, and the University of Virginia.

The program in intercollegiate athletics consists of the organization and training of "Wolfpack" teams in football, basketball, baseball, track crosscountry, wrestling, swimming, tennis, golf, soccer, 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; football practice fields; tennis courts; a swimming pool of olympic dimensions; a gymnasium; a baseball 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. Rehearsal schedules have been carefully arranged to avoid conflicts with other classes or with study time. The combined membership of these organizations constitutes the largest voluntary student organization on campus.

The Men's Glee Club

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 makes tours and provides small ensemble music for special occasions.

Bands

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 the 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.

Additional information concerning musical activities may be obtained by writing or visiting the director of music in Pullen Hall.

Student Centers

Two important centers for the extra-curricular activities of State College students are the E. S. King Religious Center and the Erdahl-Cloyd College Union.

College Union

The Erdahl-Cloyd College Union Building is not only the center for an extensive social and cultural program, but also provides facilities for recreation and relaxation. In addition to a snack bar, dining room, barber shop, and ballroom, there are meeting rooms, a library and lounge area, a gallery area for exhibits, a darkroom, craft shop, music listening room, guest rooms, a games room and a theater. The offices of the College Union and other organizations are located on the second floor.

The purpose of the College Union is to provide a facility and a program which will complement the academic life of the student and offer him an opportunity to further already existing interests and to develop new ones. Many of the programs at the College Union are organized and executed by students. Everyone is encouraged to participate in some aspect of the Union's activities.

Religious Center

In addition to the functions and activities held 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. The Center has an attractive lobby equipped with writing and reading tables and chairs, a television room, and four conference rooms where student and faculty groups may meet. The coordinator of religious affairs and several denominational chaplains have their offices in this building.

The Danforth Chapel, located in the Center, provides a place for religious services and meditation for students of 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.

D. H. Hill Library

The College's modern and well-equipped D. H. Hill Library has shelves for 400,000 volumes, seats for 900 readers, private studies and conference rooms, and well-lighted ventilated reading rooms. The Library's book stacks provide ample space for the fast-growing book collection. In addition, facilities for photoprinting and microfilming are available, and the building's service and reading areas are used as a working center for both students and faculty.

The book collection, which is primarily scientific and technological, strongly reflects the teaching and research requirements of State College. There is also available 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 exceeds 240,000 volumes. More than 3,300 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. Books for recreational reading are housed in the lobby of the building. Students may explore this area and check out books. The big well-lighted West Reading Room is an invitation to study. In addition to this room, 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 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.

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 counselors.

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 varied backgrounds, to use his leisure time pleasantly and profitably, and to grow in personality. Each dormitory elects its representatives to the Interdormitory Council, a student organization which coordinates interdormitory activities and programs. In each of seven 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 may 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 Housing Rental Office in Leazar Hall.

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

At the beginning of the 1961-62 academic year, approximately 327 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 dormitory counselor who is an upperclassman with the qualifications for, and responsibility of, helping individual students in his dormitory-particularly freshmen-in any way

that he can. Floor counselors and assistant floor counselors, chosen on the same basis, assist the dormitory counselor. Whenever these counselors 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 in residence 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 snack.

Leazar Hall

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. 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 little as \$1.25 per day or \$300 a year.

College Union and Shuttle Inn

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

Dormitory Snack Bars

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 of linen each week during the school year. A student who elects to use 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 \$10 per semester. Applications for the linen rental plan are mailed with dormitory room forms, or they may be obtained from the Housing 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

Student Supply Store

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.

Book Exchange

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 which is 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 provide for surgical operations, outside hospital care, or the services of dentists or other specialists.

Before the student enters State 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 made 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 may 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, as a supplement to the services of the infirmary. Each year complete information will be made available to students before the opening of school.
Foreign students are required to enroll in the sickness and accident insurance plan provided through the College or to have similar coverage under other insurance plans or arrangements with their sponsors.

Orientation

Several days before the registration of upperclassmen in the fall semester, new students arrive on the campus for a series of activities planned during 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 may have the opportunity of discussing matters connected with his adjustment to college life.

Counseling: Student Questions and Problems

The main source of general information for students at State College is the Division of Student Affairs which includes the various administrators handling admissions, registration, records, 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 provide information about the different curricula and to assist with long-range curricular or career planning. 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 whenever special help is needed.

Dormitory Counseling

As described in the section on *Housing*, student dormitory counselors and floor counselors and the hosts and hostesses assigned to the larger dormitories, provide assistance with various questions and problems.

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Counseling Center

The Counseling Center 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 a small materials fee is charged when tests are administered.

Placement

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

Financial Aid

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Help in meeting college expenses is available to North Carolina State College students in several forms. Financial aid, other than graduate fellowships and assistantships, is administered by the Student Financial Aid Officer under policies set by 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 visit the Student Financial Aid Office.

Scholarships, Grants-In-Aid, Loans

A student's single application for financial aid will gain consideration for all available scholarships, grants-in-aid, and long-term loans. In general, awards are approved in amounts proportionate to demonstrated need of students with satisfactory records of achievement and school citizenship. Entering freshmen also must make strong scores on the College Entrance Examination Board Scholastic Aptitude Test. The main means for providing financial aid to entering freshmen is the annual Talent For Service Scholarship Program. For the most complete consideration, high school seniors should submit application materials by February 1 of the year preceding fall enrollment. Enrolled students are encouraged to make application at the end of one school year for financial aid in the next year. There is, however, no deadline for applications, except in the cases of certain competitive scholarships which are announced. The College seeks to assign the kind of aid best suited to the needs and qualifications of the applicant, and a recipient may expect a portion of the aid offered him each year to be in the form of a loan. Renewal of financial aid is based upon the student's making a clearly satisfactory record of achievement and campus citizenship.

State College participates in the National Defense Student Loan Program, under which loans are made that draw no interest until one year after leaving college. Other college loans accrue interest at the rate of 3 per cent from the date of execution of the note. Repayments of long-term loans begin after graduation or withdrawal from college.

Emergency loans are available to meet unforeseen expenses. These loans must be repaid in 30 to 60 days and are not extended beyond the end of a term.

Graduate Fellowships

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

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-month 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

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

Part-time Employment

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.





MILITARY TRAINING

Department of Military Science

Professor of Military Science COLONEL L. W. MERRIAM Assistant Professors of Military Science:

LIEUTENANT COLONEL WILFORD L. WILLEY, LIEUTENANT COLONEL JAMES F. BARRETT, MAJOR MAX A. CRAIG, MAJOR JOSEPH W. JENKINS, MAJOR JAMES E. LAWSON MAJOR ROBERT E. WICKHAM, MAJOR WOODROW O. WILSON, CAPTAIN NORMAN G. ERIKSEN, CAPTAIN CHARLES I. MCLAIN, CAPTAIN MAYNARD E. SHIELDS

Department of Air Science

Professor of Air Science COLONEL JAMES D. HOWDER Assistant Professors of Air Science:

LIEUTENANT COLONEL FRANKLIN D. BLANTON, LIEUTENANT COLONEL EARL R. DICKEY, LIEUTENANT COLONEL MAYNARD C. CUSWORTH, MAJOR GERALD L. WATERMAN, MAJOR ROBERT J. SHELDON, CAPTAIN CHARLES W. ROWAN, CAPTAIN WILLIAM S. CLARKE, JR.

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 professor 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 called 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 is to develop in selected college students, through a permanent program of instruction at designated civilian educational institutons, those qualities of leadership and other attributes essential to their progressive advancement to positions of increasing responsibility as commissioned officers in the United States Air Force.

Course of Instruction

Programs of instruction for both Army and Air Force ROTC consist of a two-year basic course and a two-year advanced course. The satisfactory completion of the basic course in either the Army or Air Force ROTC is required for all physically fit male freshmen and sophomores unless they are excused by the college administration. (All veterans who were in active service for as long as six months are excused from this requirement, but may enroll in the basic course of Army or Air Force ROTC to qualify for later enrollment in advanced courses.)

The College provides, in cooperation with the Air Force and the Army, a flight instruction program. A limited number of highly qualified cadets from both ROTC units participate in this instruction which includes 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.

Satisfactory completion of the advanced courses qualifies a student for commissioning as a second lieutenant in the Army or Air Force Reserve upon graduation from the College. 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 utilization 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-veteran contemporaries, which remains before they are classified as academic juniors. All veterans must have completed their academic and military requirements prior to their 28th birthday.

The Air Force ROTC course of study includes instruction in 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 responsible 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 advanced course. All other positions are held by cadet noncommissioned 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 name outstanding students of the Army ROTC and Air Force ROTC 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."



SCHOOLS AND PROGRAMS OF STUDY

This section of the catalog lists the eight schools of the College and explains the programs of study within the schools.

Each of the College's schools is administered by a dean. The main academic divisions of the College are the Schools of Agriculture, Design, Education, Engineering, General Studies, Forestry, Physical Sciences and Applied Mathematics, and Textiles.

North Carolina State College, the technical branch of the Consolidated University of North Carolina, provides an opportunity for its students to obtain top-level scientific as well as technical training. Also, the students are offered the broad general education which is a necessary prerequisite to specialization.

Throughout the programs of study given in this section, departmental codes, course numbers, and course titles are used. Additional information concerning specific courses may be found in the *Description of Courses* section. The following code is given to assist in locating course descriptions.

Code Name

AC-Agricultural Communications (see Agriculture) AG-Agriculture AGC-Agricultural Economics AGE-Agricultural Engineering ANS-Animal Science ANT-Anthropology ARC-Architecture AS-Air Science BO-Botany and Bacteriology BS-Biology CE-Civil Engineering CH-Chemistry CHE-Chemical Engineering CodeNameCS--Crop ScienceDN--DesignE--EngineeringEC--Economics*ED--Education (General Courses)EE--Electrical EngineeringEH--Engineering HonorsEM--Engineering MechanicsENG--EnglishENT--EntomologyFOR--ForestryFS--Food ScienceGN--Genetics

^{*} Also, Agricultural Education courses, a few Industrial Arts courses, Industrial Education courses, Mathematics and Science Education courses, and Occupational Information and Guidance courses.

Name Code Code Name NE-Nuclear Engineering HI-History PD-Product Design HS-Horticultural Science **PE-Physical Education** IA-Industrial Arts **IE**—Industrial Engineering PHI-Philosophy ISO-International Student Orientation **PO**-Poultry Science **PP-Plant** Pathology LA-Landscape Architecture **PS**-Political Science MA-Mathematics PSM-Physical Sciences and Applied Mathematics ME-Mechanical Engineering PSY-Psychology MIC-Ceramic Engineering **PY**-Physics MIG-Geological Engineering **REL**-Religion MIM-Metallurgical Engineering **RPA-Recreation** and Park Administration ML-Modern Languages (General Courses) MLE-Modern Languages (English for **RS**-Rural Sociology Foreign Students) SOC-Sociology MLF-Modern Languages (French) SS-Social Studies SSC-Soil Science MLG-Modern Languages (German) ST-Experimental Statistics MLI-Modern Languages (Italian) MLR-Modern Languages (Russian) TC-Textile Chemistry TX-Textile Technology, Knitting Technology, MLS-Modern Languages (Spanish) and General Course MS-Military Science

ZO-Zoology







School of Agriculture

H. BROOKS JAMES, Dean

EDWARD 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.

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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 16 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 15 departments.

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, crop science, food science, dairy husbandry, horticultural science, poultry science and soil science. Agricultural Science-agricultural economics, agricultural engineering (joint program with the School of Engineering), animal husbandry, botany, crop science, food science, dairy husbandry, entomology, horticultural science, poultry science, rural sociology, soil science, wildlife biology, and zoology. Pre-veterinary work also is taken in this curriculum.

Agricultural Technology-agricultural economics, agricultural engineering, animal husbandry, crop science, dairy husbandry, horticultural science, plant protection, poultry science, and soil science.

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 Science, Crop Science, Botany, Entomology, Food Science, Genetics, Plant Pathology, Soil Science, 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 technology, science, and business. The School of Agriculture stands ready to help meet the challenge of the new concept of agriculture with forwardlooking curricula.

Freshman Year

(The departments in the School of Agriculture have a common freshman year with the exception of the science program in the Department of Agricultural Engineering. For the agricultural science, agricultural engineering freshman year see Department of Agricultural Engineering.)

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

Agricultural Business Curriculum

Sophomore Year

Fall Semester

Credits

 ENG 231, Basic Speaking Skills
 3

 CH 101, General Inorganic Chemistry
 4

 PSY 200, Introduction to Psychology
 3

 RS 301, Sociology of Rural Life
 3

 EC 201, Economics
 3

 PE 201, Physical Education
 1

 MS 201, Military Science II
 1

 or
 1

 AS 221, Air Science II
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Fall Semester	Credits
Group B Electives	6
Group A or C Electives	
Departmental Requirements	6
Free Elective	3
	18

Spring Semester	Credits
Group B Electives Departmental Requirements	6 6
Free Elective	3
	15

Senior Year

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

Agricultural Science Curriculum

Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
ML, Modern Language Elective		ML, Modern Language Elective	
or		or	
ENG, English Elective		ENG, English Elective	3
CH 101, General Inorganic Chem	istry	CH 103, General and Qualitative	
or	,	Chemistry	4
CH 105, General Inorganic Chem	istry _ 4	PY 212, General Physics	4
*PY 211, General Physics		Group D Elective	
Group D Elective		PE 202, Physical Education	1
PE 201, Physical Education		MS 202, Military Science II	
MS 201, Military Science II		or	
or	3	AS 222, Air Science II	1
AS 221, Air Science II			
	8) 	.a.?	16
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Junior Year

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Fall Semester Cre	edits	Spring Semester
Group A Elective	5	Group A, B, or C
Group D Elective	3	Group D Elective
Departmental Requirements	6	Departmental Re
Free Elective	3	Free Elective

Grou	p D Elec	tive	 3
Depa	rtmental	Requirements	 7
Free	Elective	•	3

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Senior Year

Fall Semester	Credits	Spring Semester	Credits
Group A Elective	4	Group A Electives	6
Group A, B, or C Elective	3	Group D Elective	
Departmental Requirements	7	Departmental Requirements	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 Spring Semester Credits Credits · · · · · · SOI 200, Soils ENG 231, Basic Speaking Skills _____ 3 CH 101, General Inorganic Chemistry 4 CH 103, General and Qualitative PY 221, General Physics _____ 5 Chemistry _____4 EC 201, Economics _____ 3 AGC 212, Economics of Agriculture _____ 3 PE 201, Physical Education _____ 1 RS 301, Sociology of Rural Life _____ 3 PE 202, Physical Education _____ 1 MS 201, Military Science II MS 202, Military Science II s., . . . = ಕಾರ್ಯಕ್ಷಾ ಕ್ಷ್ಣಿ ಕ್ಷಣೆ ಮೊದ or AS 221, Air Science II _____ 1 or -AS 222, Air Science II 17 16

Junior Year

Fall Semester	Credits	Spring Semester	Credits
Modern Language Elective		Group A Elective	
or	2	Group D Elective	
English Elective		Departmental Requirements	7
Group D Elective		Free Elective	
Departmental Requirements	6 .		
Group C Elective		n 4	16
Free Elective		and a second	
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	Senior	Year	
Fall Semester	Credits	Spring Semester	Credits
Group A or B Elective		Group C Electives	6
Group C Elective		Departmental Requirements	7
Departmental Requirements		Free Elective	3
Free Elective			

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Credits Required for Graduation

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Language	12	•12 22	12		12
Social Science and Humanities					
(Group D*)	21		21 ·		21
Physical and Biological Sciences	25	0.7. Y	28		33
Restricted Electives:	a a Arta			St 7 - 11	e s Ba
Group B		Group AA**	26	Group A, B	9-11
Group A and C			ार्थाः *	Group C	9-12
Introduction to Agriculture	1		1 -		1
Departmental Requirements	26	8	26		27

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.

Free Electives	12		12	12
Physical Education PE 101, 102, 201,	126 4 202	• 2 - -	126 4	126 4
Military Science I a MS 101, 102, 201, or	nd II 202	- 	*	9-92 - 91 ⁹² - 94 95
Air Science I and I AS 121, 122, 221,	I 4 222	ୟ ସ (୨)	4	4
Group Electives	à	* 23	а ж. ц.	™ ≰ ∞ ಶ
	G	iroup A		1.52
Physical Sciences			19 - E	. O
Chemistry				
CH 103 CH 107 CH 108 CH 215 CH 220	General and Qualitati General and Qualitati General and Qualitati Quantitative Analysis General and Organic	ve Chemistry ve Chemistry ve Chemistry Lal Chemistry	180 - 4400 11 - 21 12	
	All courses at 400 level	l and above		$\cdot \cdot $
Mathematics MA 201 MA 202 MA 211, 212 MA 215	Calculus I Calculus II Analytical Geometry a Finite Mathematics	nd Calculus		n ⁴ 16 16 16 16 16 16 16 16 16 16 16 16 16
	All courses at 300 leve	and above	÷	50 J. K. J.
Mineral Industries MIG 120 MIG 222 MIG 323	Physical Geology Historical Geology Paleontology	8 ₁₁		
MIG 330 MIG 442	Mineralogy Petrology	1997) (1994) 1	12 (5	a ^r ia 2
Physics		99° * 8 3 *	2	41 1941

Physics	and the second	397 <u>a</u> ¹⁶ 5
PY 202 or 212	General Physics	#3
PY 223	Astronomy and Astrophysics	
	All courses at 300 level and above	* * *
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Soil Science	, * 8 ₂ * = 3	- F
SSC 200	Soils	
SSC 302	Soils and Plant Growth	
SSC 452	Soil Classification	an a
SSC 511	Soil Physics	
SSC 521	Soil Chemistry	3#0. ¹²⁴
SSC 551	Soil Morphology, Genesis and Classification	8 ²
Statistics		
STC 909		
51 502	Statistical Laboratory	
ST 311	Introduction to Statistics	
ST 361, 362	Introduction to Statistics for Engineers I, II	ಟ
	All courses at 500 level	ર વિષ

Biological Sciences

Agricultural Engine	ering
AGE 303	Energy Conversion for Agricultural Production
Animal Science	
ANS 312	Principles of Livestock Nutrition
ANS 408	Reproduction and Lactation
Bacteriology	2
BO 412	General Bacteriology
Botany	
BO 214	Dendrology
BO 403	Systematic Botany
BO 421	Plant Physiology
BO 441	Plant Ecology
	All courses at 500 level
Entomology	
ENT 301	Introduction to Forest Insects
ENT 312	Economic Entomology
	All courses at 500 level
Food Science	24 25 18
FS 502	Food Chemistry
FS 505	Food Microbiology
FS 506	Advanced Food Microbiology
Genetics	의 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전
GN 301	Genetics in Human Affairs
GN 411	Principles of Genetics
GN 512	Genetics
GN 513	Cytogenetics
Plant Pathology	2
PP 315	Plant Diseases
PP 318	Diseases of Forest Trees
PP 500	Advanced Plant Pathology

PP	501	Advanced	Plant	Pathology	Lab,	Field Crop	Diseas	es
PP	502	Advanced	Plant	Pathology	Lab,	Horticulture	Crop	Diseases

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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 301 Animal Physiology
- ZO 315 Animal Parasitology

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 will select one course each in the areas of accounting, macro-economics, marketing, and management. In addition, two courses will be selected in the area of general business and two courses in general economics. It is suggested that students in Agricultural Science and Agricultural Technology choose Group B electives from the first four areas.

1. Accounting:	EC 312	Accounting for Engineers*
2. Macro-economics:	EC 302	National Income and Economic Welfare
3. Marketing:	EC 411 or	Marketing Methods
	AGC 311	Organization and Business Management of Marketing Firms
4. Management:	EC 425 or	Industrial Management
	AGC 303	Organization and Business Management of Farms

- 5. General Business: (select two courses)
 - EC 315 Salesmanship
 - EC 401, 402 Principles of Accounting**
 - EC 407 Business Law I
 - EC 409 Introduction to Production Costs
 - EC 414 Tax Accounting
 - EC 420 Corporation Finance
 - EC 426 Personnel Management
 - EC 431 Labor Problems
 - EC 432 Industrial Relations
 - EC 525 Management Policy and Decision Making
 - AGC 413 Farm Appraisal and Finance
 - AGC 523 Planning Farm and Area Adjustments
- 6. General Economics: (select two courses)
 - EC 310 Economics of the Firm
 - EC 410 Industry Studies
 - EC 413 Competition, Monopoly and Public Policy
 - EC 440 Economics of Growth
 - EC 446 Economic Forecasting
 - EC 448 International Economics
 - EC 450 Economic Decision Processes
 - AGC 521 Procurement, Processing & Distribution of Agricultural Products
 - AGC 533 Agricultural Policy

AGC 551 Agricultural Production Economics

Group C

Applied Science and Technology

Agricultural Communications

AC 311 Agricultural Communications Methods and Media

Agricultural Engineering

0 0	U
AGE 201	Farm Shop Woodwork
AGE 202	Farm Shop Metalwork
AGE 211	Farm Power and Machinery I
AGE 321	Irrigation, Drainage and Terracing
AGE 332	Farm Building and Crop Processing
AGE 341	Farm Electrification and Utilities

* If a one year sequence in accounting is desired, the student should elect EC 409 from Group 5. ** EC 401 may be substituted for EC 312 if the sequence EC 401, 402 is preferred.

Animal Science

ANS 201	Elements Dairy Science
ANS 202	Fundamentals of Animal Husbandry
ANS 302	Selecting Dairy and Meat Animals
ANS 308	Advanced Selecting Dairy and Meat Animals
ANS 404	Dairy Farm Problems
ANS 407	Advanced Livestock Production
ANS 503	Animal Breeding
ANS 505	Diseases of Farm Animals

Crop Science

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

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Entomology

Food Science

FS 303	Meat and Meat Products
FS 309	Meat Selection
FS 401	Mktg. Milk and Related Products
FS 404	Poultry Products

Beekeeping

Horticultural Science

HS 201	Principles of Horticulture				
HS 301	Plant Propagation		8	۲	
HS 342	Landscape Gardening	£.,	0 25		
HS 421	Fruit Production		20		
HS 432	Vegetable Production				
HS 441, 442	Floriculture I and II	100	±0 ≉ ≈ >	* *	112
HS 481	Breeding of Horticulture Plan	nts			

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Poultry Science

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

Soil Science	ತ್ರಾ ಕ್ಷ್ಮಿ ಕ್ಷ್ಮಿ ಕ್ಷ್ಮಾನ್ ಕ್ಷ್ಮಾನ್ ಕ್ಷ	E.
SSC 341	Soil Fertility and Fertilizers	
SSC 461	Soil Conservation and Management	
Zoology		
ZO 312	Principles of Game Management	*
ZO 321	Wildlife and Natural Resource Conservation	
ZO 521	Fishery Biology	* 5
ZO 551, 552	Wildlife Management	

Group C Electives in Other Schools

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Engineering	
EM 341	Mechanics A (Statics)
EM 342	Mechanics B (Dynamics)
EM 343	Strength of Materials A
IE 332	Motion and Time Study
MIM 321	Metallurgy

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Forestry

FOR 311 Principles of Farm Forestry

Psychology

PSY 337 Industrial Psychology I

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

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Group D

Social Science and Humanities

Agricultural Economics

AGC	212	Economics of Agriculture
AGC	512	Economic Analysis of Factor Markets

Economics

EC 201, 202	Economic Principles
EC 301	Production and Prices
EC 310	Economics of the Firm
EC 440	Economics of Growth
EC 442	Evolution of Economic Ideas
EC 446	Economic Forecasting
EC 448	International Economics
EC 501	Intermediate Economic Theory
EC 502	Money, Income and Employment
EC 541	Origins of the United States Economy
EC 550	Mathematical Models in Economics
EC 552	Econometrics
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
PS 376	Latin American Governments and Politics
	All courses at 400 level and above

Philosophy and Religion

PHI 201	Logics	a ^{ra} * .	1
PHI 203	Introduction to Philosophy		
PHI 205	Problems and Types of Philosophy		8
REL 301	Religious Groups & Trends in the	U. S.	n g i da
REL 302	The Bible and Its Background	5. .	
REL 303	Christian Ethics		
PHI 305	Philosophy of Religion		12
PHI 306	Philosophy of Art	- 	a ⁶⁸
PHI 307	Ethics		i 1
PHI 309	Marriage and Family Living		
PHI 311	Parent-Child Relationships	T:	
PHI 395	Philosophical Analysis		
	All courses at 400 level and above		

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Psychology

PSY 200	Introduction to Psychology
PSY 201	Elementary Experimental Psychology
PSY 302	Psychology of Personality and Adjustment
PSY 304	Educational Psychology
PSY 337	Industrial Psychology I
	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 305	People of the World
ANT 251	Physical Anthropology
ANT 252	Cultural Anthropology
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	Criminology
Ϊ.	All courses at 400 level and above

Social Studies

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

Other courses in Social Sciences and Humanities not presently listed may be elected upon approval of the director of instruction.

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Department of Agricultural Economics

Professor CHARLES E. BISHOP, Head of the Department

TEACHING AND RESEARCH

Professors:

ARTHUR J. COUTU, H. BROOKS JAMES, RICHARD A. KING, JAMES G. MADDOX, WALTER H. PIERCE, GEORGE S. TOLLEY, WILLIAM D. TOUSSAINT

Visiting Professor: ERWIN E. LIEBHAFSKY

Associate Professors:

WILLIAM R. HENRY, JAMES A. SEAGRAVES, T. DUDLEY WALLACE, JAMES C. WILLIAMSON, JR. Assistant Professors:

DALE M. HOOVER, LOREN A. IHNEN, DUANE F. NEUMAN, R. JAMES PEELER, JR., RICHARD L. SIMMONS

Instructors:

WAYNE E. BOYET, GARNETT L. BRADFORD, ADGER B. CARROLL, BOBBY R. EDDLEMAN, WARREN E. JOHNSTON, JOSEPH C. MATTHEWS, JR., JOHN W. NIXON, GORDON S. SANFORD, T. KELLEY WHITE, JR.

EXTENSION

Associate Professor CHARLES R. PUGH, In Charge of Farm Management Professor:

WILLIAM L. TURNER

Associate Professors:

ROBERT L. JOHNSTONE, CLYDE R. WEATHERS

Assistant Professors:

JAMES G. ALLGOOD, E. WALTON JONES

Instructors:

HUGH L. LINER, FRED A. MANGUM, PAUL S. STONE Professor George L. CAPEL, In Charge of Marketing

Professor:

CLAYTON P. LIBEAU

Associate Professors:

ROBERT S. BOAL, GUY R. CASSELL, HENRY A. HOMME, T. EVERETT NICHOLS, JR., EDWIN A. PROCTOR

Assistant Professors:

MAURICE E. THIGPEN, RUBY P. UZZLE

Instructor:

ROBERT D. DAHLE

The Department of Agricultural Economics offers programs of study lead-

ing 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 educational 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 the agricultural business and agricultural science curricula in the School of Agriculture. In addition, students must meet all of the basic requirements of the College and the School of Agriculture.

For the freshman year and basic requirements see pages 54 and 55.

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

AGRICULTURE 65

Group B Courses (24 Credits)

Cre	edits
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 512, Accounting for Engineers	
EC 401 Principles of Accounting	9
EC 407. Business Law I	о 2
Electives	6
ੇ ਨੇ 1, 200 ਨਿੰਡ ਦੇ 11 ਕਿਸੇ 1 ਕਿਉਂ 18 ਕਿਸ ਦੇ ਦੱਸ ਸੱਜ ਦੇ 11 ਕਿਸ ਦੇ 1	Ŭ
Group A and C Courses (6 Credits)	÷
CH 103, General and Qualitative Chemistry	4
Electives	2
	oran or
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	2
AGC 523, Planning Farm and Area Adjustments	3
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Agricultural Science-The requirements of the agricultural science c	ur-
riculum are as follows:	
Group A Courses (26 Credits)	
MA 211 and 212. Analytic Geometry and Calculus B C	aits
or	74
MA 201 and 202, Analytic Geometry and Calculus II and III6 o	or 8
Electives18 or	r 20
Departmental Requirements and Electives (26 Credits)	

AGC 303, Organization and Business Management of Farms _______ 3

AGC 311, Organization and Business Management of	Marketing Firms 3	3
AGC 533, Agricultural Policy	^	3
AGC 551, Agricultural Production Economics		3
AGC 552, Consumption, Distribution, and Prices in	Agriculture 3	3
ST 311, Introduction to Statistics	3	3
EC 312, Accounting for Engineers	÷ .	
or	10 ¹² 0	
EC 401, Principles of Accounting		;
Electives	5	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.

Department of Agricultural Engineering

Professor F. J. HASSLER, Head of the Department

TEACHING AND RESEARCH

Professors:

H. D. BOWEN, J. M. FORE, W. E. SPLINTER, JAN VAN SCHILFGAARDE, JOHN W. WEAVER, JR. Associate Professor:

EZRA L. HOWELL

Assistant Professors:

GEORGE B. BLUM, JR., W. H. JOHNSON, K. A. JORDAN, DAVID A. LINK, C. W. SUGGS Instructors:

E. O. BEASLEY, J. F. BEEMAN, E. G. HUMPHRIES, EDWARD H. WISER, F. SCOTT WRIGHT Head Mechanic:

RALPH B. GREENE

EXTENSION

Professor H. M. ELLIS, In Charge

Associate Professors:

J. C. FERGUSON, R. M. RITCHIE, W. C. WARRICK Assistant Professors:

J. W. GLOVER, R. W. WATKINS Instructor:

R. E. SNEED

Students in agricultural engineering are educated and trained to deal with 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, etc.; 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.

Since agricultural engineering involves two distinct technical fieldsagriculture and engineering-this curriculum is a joint responsibility of the two schools and is so administered. Graduates in the program receive the degree of Bachelor of Science in Agricultural Engineering.

Freshman

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Cma	dita
UIE	aus

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ENG 111, 112, English Composit MA 101, 102, Algebra and Trigor	ion	Ana	lytic	Geo	metry	and	Calc	ulus I		 	6 9
CH 101. General Chemistry I	ture							 .			I 4
AGE 151, 152, Farm Mechanics			5 X	9 3 				¥1.]			4
ME 101, 102, Engineering Graphi	cs I, II				ж ^ж		• • •				4
MS 101, 102, Military Science I	·· .	¥2 = 0	3* *	÷Ť	. ⁵ 2	4		× .	fr j	*	
or AS 121, 122, Air Science I	•	ь В	· . ⁹			â.	и л неи			ų	2
PE 101, 102, Physical Education							(·		2
a na among na sa a ^a na a gan banka a k	: · . · i	18	149 [°]							* * *	.32
		Sopł	iomo	re						2	Cradita
EM 200, Introduction to Mechan	uics			22	/ K /	1. 	ઓં. •	r • 1	•= ¹⁰	• •	3
CH 105, General Chemistry II _ CE 201, Surveying I			*******								<u>4</u> ` :
AGE 211, Farm Power and Mach	inery										3
MA 201, 202, Analytic Geometry :	and Calo	culus	IIa	ind 1	III	्। 					8
PY 201, 202, General Physics	·····			2			<u></u>		•		10
MS 201, 202, Military Science II	57 1			\sim 32				÷ , ,	8 48 60		
or											

AS	221,	222,	Air Science	e II	2
PE	201,	202,	, Physical	Education	 2

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Credits

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Junior

BO 103, General Botany	
EC 201, Economics	
EE 320, Elements of Electrical Engineering	
EM 301, Solid Mechanics I	ay an i
EM 303, Fluid Mechanics I	
ENG 231, Basic Speaking Skills	· · · · · · · · · · · · · · · · · · ·
ME 301, Engineering Thermodynamics I	
MA 301, Differential Equations	•
SSC 200, Soils	
English Elective	с с.
Electives	······································

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Senior	е ж. ¹⁹ ж	Credits
HI 261, The United States in Western Civilization		
AGC 212, Economics of Agriculture		
or		
AGC 551, Agricultural Production Economics		
AGE 371, Soil and Water Conservation Engineering		4
AGE 451, Conditioning Principles for Plant and Animal Systems		2
AGE 452, Senior Seminar	e	1
AGE 462, Farm Power and Machinery IIA		4
AGE 481. Agricultural Structures as Production Units		4
AGE 491, Rural Electrification		4
AGE 552. Instrumentation for Agricultural Research and Processing		1
PS 201. The American Governmental System		
RS 301, Sociology of Rural Life		3
Humanities Elective		3
Flectives		6

41

Credits

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. Graduates from this program will receive the degree of Bachelor of Science in Agriculture.

For the freshman year program in agricultural engineering technology see page 54.

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

Group A and B Courses (9-11 Credits)

*PY 211, 212,	General	Physics	(8	credits	total)	 3
	Electives					 8

Group C Courses (9-11 Credits)

9--11 Electives

Departmental Requirements and Electives (27 Credits)

AGE	151,	152, Farm Mechanics 4
AGE	211,	Farm Power and Machinery 3
AGE	303,	Energy Conversion 2
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,	Seminar1
ME 1	01, 1	Engineering Graphics I 2
AGE	331,	Food Process Engineering 3
* PY	211 0	and 212 will be taken in place of PY 221 as shown in the Agricultural Technology Curriculum.

These 3 additional credits are Group A electives required by the department.

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.

Agronomy

See Crop Science and Soil Science

Department of Animal Science

Professor I. D. PORTERFIELD, Head of the Department TEACHING AND RESEARCH Professors: E. R. BARRICK, E. G. BATTE, J. E. LEGATES, H. A. STEWART, G. MATRONE, W. R. MURLEY, F. H. SMITH, S. B. TOVE, L. C. ULBERG, G. H. WISE Associate Professors:

A. J. CLAWSON, E. U. DILLARD, LEMUEL GOODE, J. G. LEECE, R. D. MOCHRIE, H. A. RAMSEY, W. W. G. SMART, JR., M. B. WISE

Assistant Professors: H. B. CRAIG, J. P. EVERETT, J. M. LEATHERWOOD, J. J. MCNEILL, D. J. MONCOL, J. L. MOORE, R. M. MYERS, O. W. ROBISON

Instructors:

G. L. Ellis, I. J. Ellis, J. H. Gregory, D. O. Morgan, J. D. Pettyjohn, W. L. Tucker EXTENSION

Professors:

A. V. Allen, T. C. Blalock, J. S. Buchanan, Jack Kelley, M. E. Senger Associate Professors:

J. D. GEORGE, G. S. PARSONS, J. W. PATTERSON, J. R. WOODARD Assistant Professors:

F. N. KNOTT, R. L. MCGUIRE, R. R. RICH, D. G. SPRUILL

Undergraduate students in the Department of Animal Science are instructed in the basic principles of subjects relating to various phases of dairy and livestock production. To meet the needs of specialized interests, two majors, animal husbandry and dairy husbandry, are offered in each of the three curricula in the School of Agriculture. A third major, animal nutrition, in the agricultural science curriculum, is in the advanced planning stage. Thus, the purpose of these offerings is to present challenges to and to provide preparation of students from various backgrounds for

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constructive and progressive participation in the ever-expanding fields of animal agriculture.

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Opportunities

There are many and varied opportunities for students who major in any of the animal industry programs.

Animal Husbandry

Kinds of work for which graduates are qualified include the following: farm operations, livestock management, fieldmen for breed associations and livestock organizations, agricultural extension, education work with business and industries serving agriculture, meat grading, communications (livestock and market news with radio and TV stations), sales work with feed, equipment and pharmaceutical companies, graduate study, research with industry and educational institutions, livestock buying and livestock and farm loans with banks and lending agencies.

Dairy Husbandry

Kinds of work for which graduates are qualified include: 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.

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.

For the freshman year and basic requirements see pages 54-56.

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)	Credits
CH 351, Introductory Biochemistry ZO 301, Animal Physiology	3 3
Departmental Requirements and Electives (26 Credits)	Credits
ANS 202, Fundamentals of Animal Husbandry	
ANS 303, Meat and Meat Products	3
ANS 406, Animal Industry Seminar	<u>1</u> ·
CH 103, General and Qualitative Chemistry	4 4
GN 411, The Principles of Genetics	3
ANS 407, Advanced Livestock Production	4
Agricultural Science-The requirements of the agricultural s	cience cur-
riculum are as follows:	8 II - 2

AGRICULTURE 71

Group A Courses (25 Credits)

Credits

BO	312,	General Bacteriology	Ł
СН	351,	Introductory Biochemistry	3
ZO	301,	Animal Physiology	3
GN	411,	The Principles of Genetics	3
8		*Electives12	ŀ.

Departmental Requirements and Electives (26 Credits)

Credits

ANS	202,	Fundamentals of Animal Husbandry	4
ANS	303,	Meat and Meat Products	8
ANS	312,	Principles of Livestock Nutrition	3
ANS	406,	Animal Industry Seminar	1
ANS	408,	Reproduction and Lactation	4
ANS	503,	(GN 503), Genetic Improvement of Livestock	<u> </u>
ANS	505,	Animal Diseases	3
ANS	407,	Advanced Livestock Production	4
್ಷಕ	62	Elective	1

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

Group A and B Courses (10 Credits)

			Gicu.	00
BO	312,	General Bacteriology	4	
CH	351,	Introductory Biochemistry		
ZO	301,	Animal Physiology		
2				

Group C Courses (11 Credits)

Credits

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Credite

Electives _____

Departmental Requirements and Electives (27 Credits)

Credits

ANS 202, Fundamentals of Animal Husbandry			4
ANS 302, Selecting Dairy and Meat Animals		3.2 I 4	
ANS 303, Meat and Meat Products			3
ANS 312, Principles of Livestock Nutrition			3
ANS 406, Animal Industry Seminar			1
ANS 503, (GN 503), Genetic Improvement of Livestock	×.,	e 15	3
CH 103, General and Qualitiative Chemistry			4
GN 411, The Principles of Genetics	ii	A 1	. 3
ANS 407, Advanced Livestock Production			4

Undergraduate Curriculum—Dairy Husbandry

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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.

For the freshman year and basic requirements see pages 54-56.

Agricultural Business-The requirements of the agricultural business curriculum are as follows:

Group B Courses (24 Credits)

Electives ______ 24

* Six credits may be elected from Groups B and C.
Group A Courses (7 Credits)

Crea
GN 411, Principles of Genetics
ZO 301, Animal Physiology
Departmental Requirements and Electives (25 Credits)
ANS 201, Elements of Dairy Science
ANS 312, Principles of Livestock Nutrition
BO 312, General Bacteriology
ANS 404, Dairy Farm Problems
ANS 406, Animal Industry Seminar
CH 103, General and Qualitative Chemistry
CH 351, Introductory Biochemistry
ANS 408, Reproduction and Lactation
riculum are as follows: Group A Courses (26 Credits)
Cre
ZO 301, Animal Physiology
CH 351, Introductory Biochemistry
GN 411, Principles of Genetics
*Electives
Departmental Requirements and Electives (26 Credits)
ANS 201, Elements of Dairy Science
ANS 319 Principles of Livestock Nutrition
BO 319 General Bacteriology
ANS 404. Dairy Farm Problems
ANS 406. Animal Industry Seminar
ANS 408, Reproduction and Lactation
ANS 503, (GN 503), Genetic Improvement of LivestockElective
Agricultural Technology—The requirements of the agricultural te nology curriculum are as follows:
Group A and B Courses (10-13 Credits)

Credits

Credits

ZO 301	Animal Physiology	4	8
CH 351	Introductory Biochemistry	3	14
GN 411	The Principles of Genetics	3	
1 - 1 ²	Electives0	-3	

Group C Courses (9-12 Credits)

Electives	
Departmental Requirements and Electives (26 Credits)	Credits
ANS 201, Elements of Dairy Science	
ANS 302, Selecting Dairy and Meat Animals	
ANS 312, Principles of Livestock Nutrition	
BO 312, General Bacteriology	4
ANS 404, Dairy Farm Problems	
ANS 406, Animal Industry Seminar	1
ANS 408, Reproduction and Lactation	
ANS 503, (GN 503), Genetic Improvement of Livestock	
Electives	3
t Six gradite may be elected from Groups B & C	

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

Graduate Study

The Department of Animal Industry offers the Master of Science and Doctor of Philosophy degrees in animal industry. The degrees of 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.

Department of Botany and Bacteriology

Professor H. T. Scofield, Head of the Department TEACHING AND RESEARCH Professors:

E. A. BALL, J. B. EVANS, L. A. WHITFORD Associate Professors:

E. O. BEAL, J. W. HARDIN, J. R. TROYER Assistant Professors:

F. B. ARMSTRONG, A. W. COOPER, G. H. ELKAN, JOSEPH S. KAHN, HEINZ SELTMANN Research Associate:

W. J. DOBROGOSZ

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. For the freshman year and basic requirements see pages 54 and 55. The general requirements of the agricultural science curriculum are as follows:

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Group A Courses (25 Credits)

Credits

Credits

CH 103, General and Qualitative Chemistry _____4 *Electives (6 credits may be elected from Groups B and C) _____21

Departmental Requirements and Electives (27 Credits)

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	4
BO 412, General Bacteriology	4
Elective	3

Undergraduate Curriculum—Bacteriology

The department does not offer an undergraduate major program in bacteriology, however, programs can be arranged to provide training that is well suited to prepare a student for graduate work in bacteriology or microbiology or to seek employment as a bacteriologist.

Anyone interested in undergraduate work emphasizing bacteriology should see a departmental adviser.

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.

Department of Crop Science

Professor P. H. HARVEY, Head of the Department

TEACHING AND RESEARCH Professors:

D. S. CHAMBLEE, D. U. GERSTEL, W. C. GREGORY, G. L. JONES, K. R. KELLER, G. C. KLING-MAN, R. L. LOVVORN, T. J. MANN, P. A. MILLER, R. P. MOORE, J. C. RICE, J. A. WEYBREW Associate Professors:

C. A. BRIM, J. W. DUDLEY, D. A. EMERY, H. D. GROSS, L. A. JONES, W. M. LEWIS, F. W. MCLAUGHLIN, D. E. MORELAND, L. L. PHILLIPS, LUTHER SHAW, D. L. THOMPSON, D. H. TIMOTHY, R. P. UPCHURCH

Professor Emeritus:

G. K. MIDDLETON

Assistant Professors:

W. A. COPE, W. T. FIKE, W. B. GILBERT, G. R. GWYNN, J. L. HALL, J. A. LEE, J. R. MAUNEY, D. A. MILLER, C. F. MURPHY, E. C. SISLER, D. C. WHITENBERG Instructor:

F. L. SELMAN

EXTENSION

Professor E. R. Collins, In Charge of Agronomy Extension

Professors:

R. R. BENNETT, S. H. DOBSON, A. D. STUART

• No more than 6 hours of Group A electives may be courses in the Department of Botany and Bacteriology.

Associate Professors: S. N. HAWKS, ASTOR PERRY Assistant Professors: C. T. BLAKE, D. M. GOSSETT, A. D. WORSHAM Intructor: W. G. TOOMEY

The curriculum in crop science 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 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 Crop Science is housed in Williams Hall.

Opportunities

Graduates in crop science 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 crop science 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 crop science can be earned under any of the three curricula in the School of Agriculture.

For the freshman year and basic requirements see pages 54-56. 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
AGC 311, Organization and Business Management of Marketing Firms	3
EC 407, Buisiness Law I	3
Electives1	.5

Group A and C Courses (5 Credits)

GN	411,	The	Princ	iples	of	Genetics	 3
		Elect	ive				 2

Departmental Requirements and Elective	es (26 Credits)
CS 211, Field Crops I	3
CS 312, Pastures and Forage Crops	3
CS 414, Weeds and Their Control	
BO 421, Plant Physiology	
ENT 312, Economic Entomology	3
PP 315, Plant Diseases	
SSC 200, Soils	
SSC 302, Soils and Plant Growth	à e
or	
SSC 341, Soil Fertility and Fertilizers	3
Agricultural Science-The requirements of th	he agricultural science cur
riculum are as follows:	
	
Group A Courses (25 Credi	rs)
BO 312, General Bacteriology	
GN 411, The Principles of Genetics	
PP 315, Plant Diseases	3
MA 201, Analytic Geometry and Calculus II	
or	
MA 211, Analytic Geometry and Calculus B	3
*Electives	11 of 12
Departmental Requirements and Elective	es (26 Cr edits)
	Credi
CS 211, Field Crops I	
CS 312, Pastures and Forage Crops	3
CS 414, Weeds and Their Control	
BO 421. Plant Physiology	

ENT 312, Economic Entomology ______ 3 SSC 200, Soils ______ 4 SSC 302, Soils and Plant Growth or SSC 341, Soil Fertility and Fertilizers ______ 3 Elective ______ 3

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

Group A and B Courses (8-11 Credits)

Credits

GN 411, The Principles of Genetics	
PP 315. Plant Diseases	
Electives	2-5
	8 K.

Group C Courses (9-12 Credits)

Electives _____9-12

Departmental Requirements and Electives (27 Credits)

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

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

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

Graduate Study

The Department of Crop Science 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.

Dairy Husbandry

See Animal Science

Department of Entomology

Professor CLYDE F. SMITH, Head of the Department TEACHING AND RESEARCH Professor Emeritus: T. B. MITCHELL Professors: C. H. BRETT, F. E. GUTHRIE, D. A. YOUNG, JR. Associate Professors: W. V. CAMPBELL, M. H. FARRIER, W. J. MISTRIC, R. L. RABB Assistant Professors: R. C. AXTELL, W. C. DAUTERMAN, E. HODGSON, H. H. NEUNZIG Instructors: M. D. JACKSON, H. B. MOORE, D. A. MOUNT RESEARCH Assistant Professors: R. B. CHALFANT, G. F. TURNIPSEED EXTENSION Professor: G. D. JONES Assistant Professor:

R. L. ROBERTSON TEACHING AND EXTENSION Assistant Professor: W. A. STEPHEN

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 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.

For the freshman year and basic requirements see pages 54 and 55.

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

		¥.	**************************************	Creat	ES
SSC 200, Soils				4	
or			E.	or	
MIG 120, Geology					
BO 312, General Bacteriology				4	
GN 411, Principles of Genetics					a.,
CH 351, Introductory Biochemistry, or Equivalent					8
ST 311, Introduction to Statistics					€.,
BO 421, Plant Physiology				4	
or				or	
ZO 301, Animal Physiology					
ZO 205, Invertebrate Zoology	· · · · ·				
*Elective					

Group A Courses (26 or 28 Credits)

Departmental Requirements and Electives (20 Credits)

ENT 312, Economic Entomology

or	*S1 - 8	×			
ENT 301, General Entomology				3	
ENT 511, Systematic Entomology				3	
Advised Electives			1	4	

Agricultural Technology-The Departments of Crop Science, 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.

^{*} May be taken from Groups B and C.

Department of Food Science

Professor W. M. ROBERTS, Head of the Department TEACHING AND RESEARCH Professors: L. W. AURAND, T. N. BLUMER, J. L. ETCHELLS, W. M. HOOVER, I. D. JONES, M. L. SPECK Associate Professors: T. A. BELL, D. FROMM, F. G. WARREN Assistant Professors: H. B. CRAIG, M. E. GREGORY, V. A. JONES Instructor: C. W. DILL EXTENSION Professor: J. A. CHRISTIAN Associate Professor: F. B. THOMAS Instructor: J. F. WILES

The Department of Food Science has the objectives of providing undergraduate and graduate programs for the application and coordination of basic training in the physical and biological sciences, economics and engineering to the development, processing, packaging, quality control, distribution and utilization of foods.

The department maintains modern and fully-equipped laboratories for teaching and research programs in dairy, fruit, meat, poultry, seafood, and vegetable products.

The department head and several staff members of the Department of Food Science are housed in Polk Hall. Other staff members and teaching and research facilities are housed in Kilgore and Scott Halls.

Opportunities

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

Specific job opportunities in the food industries are procurement, processing, management, quality control, research and development, distribution, sales and merchandising. Some of the job opportunities in allied industries include sales and service representatives of companies manufacturing equipment and supplies for the food industries, consulting activities and trade association promotional and educational services.

Food scientists hold educational and regulatory positions in extension service, inspection, grading, research and development and quality control of foods with various State and Federal governmental agencies. Food scientists are in demand for teaching and research positions with colleges and universities.

Undergraduate Curriculum

The degree of Bachelor of Science with a major in food science and processing can be earned under any of the three curricula in the School of Agriculture.

For the freshman year and basic requirements see pages 54-56.

Agricultural Business-The requirements of the Agricultural Business curriculum are as follows:

Group A Courses (8 Credits)

Credits

BO 412, General Bacteriology _____ 4 CH 103, General Chemistry II _____ 4 Group B Courses (24 Credits) Electives _____ 24 Departmental Requirements and Electives (23 Credits)

 FS 301, Food Composition
 3

 FS 331, Food Engineering
 3

 FS 505, Food Microbiology _____ 3 FS 511, Food Science Seminar _____ 1 Electives _____13 Agricultural Science-The requirements of the Agricultural Science curriculum are as follows: Group A Courses (25 Credits) Credits BO 412, General Bacteriology _____ 4 CH 221, Organic Chemistry I _____ 4 CH 215, Quantitative Analysis _____4 CH 351, Introductory Biochemistry _____ 3 Electives _____10

Departmental Requirements and Electives (26 Credits)

FS 331, Food Engineering 3	ĥ
FS 502, Food Chemistry 3	ŝ
FS 505, Food Microbiology 3	ц. Д
FS 511, Food Science Seminar 1	
Electives16	Ê.
Agricultural Technology-The requirements of the Agricultural Tech	h-
nology curriculum are as follows:	
Group A Courses (12 Credits)	
BO 312, General Bacteriology4	
CH 221, Organic Chemistry I4	ž s
CH 215, Quantitative Analysis 4	Ĕ
Group C Courses (9 Credits)	
Electives9	ĺ
Departmental Requirements and Electives (26 Credits)	
CH 851 Introductory Biochemistry	;
ES 221 Food Engineering 3	5
FS 509 Food Chemistry	;
FS 502, FOOU Chemistry 3	5
FS 505, Microbiology 1	i.
FS 511, FOOU Science Scininal13	3

Graduate Study

The Department of Food Science offers graduate programs of study leading to the Master of Science and Doctor of Philosophy degrees. Corollary instruction is provided in the biological and physical sciences. Areas of study and research include: (1) food chemistry; (2) food microbiology, and (3) food process and product development. These areas comprise all foods including dairy, fruit, meat, poultry, seafood, and vegetable products.

Department of Genetics

Professor H. F. ROBINSON, Head of the Department TEACHING AND RESEARCH Professors: C. H. BOSTIAN, D. S. GROSCH, W. D. HANSON, BEN W. SMITH, S. G. STEPHENS Associate Professors: KEN-ICHI KOJIMA, D. F. MATZINGER, R. H. MOLL Assistant Professors: F. B. ARMSTRONG, L. E. METTLER Associate Geneticist: M. PFLUGE GREGORY Research Assistant Professor: WILFRED SHUTZ Cooperating with the following associate members of the faculty: Animal Science: D. U. DILLARD, J. E. LEGATES, O. W. ROBISON, H. A. STEWART Botany: E. O. BEAL, J. W. HARDIN Crop Science: P. H. HARVEY, C. A. BRIM, 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, P. A. MILLER, L. L. PHILLIPS, D. L. THOMPSON, D. H. TIMOTHY Horticultural Science: F. D. COCHRAN, G. J. GALLETTA, F. L. HAYNES, W. R. HENDERSON, D. T. POPE Plant Pathology: J. L. Apple, Richard Gwyn, T. T. Hebert, E. L. Moore, R. R. Nelson, N. N. WINSTEAD **Poultry Science:** E. W. GLAZENER, W. L. BLOW, G. A. MARTIN

Forestry:

T. O. PERRY, B. J. ZOBEL Statistics:

C. CLARK COCKERHAM, J. O. RAWLINGS

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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 department does not have a program leading to a Bachelor of Science degree.

Graduate Study

Graduate study is carried out under the direction 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. Programs of research in biochemical genetics utilize microorganisms in the basic studies of genetic phenomena and gene action. The varied but coordinated interests of the genetics faculty with their research programs offer 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.

Department of Horticultural Science

Professor FRED D. COCHRAN, Head of the Department
TEACHING AND RESEARCH
Professors:

M. E. GARDNER, F. L. HAYNES, JR., J. M. JENKINS, JR., D. T. POPE, G. O. RANDALL

Associate Professors:

W. E. BALLINGER, L. K. KUSHMAN, C. L. MCCOMBS, C. H. MILLER

Assistant Professors:

T. F. CANNON, F. E. CORRELL, A. S. FISH, G. J. GALLETTA, W. R. HENDERSON, T. R. KONSLER, R. A. LARSON, D. C. ZEIGER

Instructor:

V. H. UNDERWOOD

Professor J. H. HARRIS, In Charge Professors:

A. A. BANADYGA, H. M. COVINGTON, M. H. KOLBE Associate Professor:

B. L. JAMES

The undergraduate programs in horticultural science offer broad training in the physical and biological sciences and business, as well as a sound cultural background, to prepare students for graduate study or for diverse professional services in the fruit and vegetable crops field, in floriculture, and in nursery management and landscape horticulture.

The varied climatic conditions in North Carolina make possible the production of a wide variety of horticultural crops commercially, as well as in parks and gardens. While these crops now represent an important segment of agriculture in North Carolina, further expansion will be realized with the 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, sales, and service. Among these are county extension agents; landscaping and landscape contracting; farm operators; orchard, nursery, greenhouse and flower shop managers; research, production, and promotional specialists with commercial seed, floral, fertilizer, chemical, and food companies; inspectors and quality control technologists; USDA specialists; and as leaders in other phases of agricultural and industrial developments. 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 horticultural science can be earned in either of the three curricula . . . business, science, or technology . . . offered by the School of Agriculture. Under these curricula, specialized training is offered for horticultural science majors in fruit and vegetable crops, and in floriculture, nursery management, and landscape horticulture.

For the freshman year and basic requirements see pages 54-56.

Agricultural Business-The requirements of the agricultural business curriculum are as follows:



SSC 2	00, S	oils		 		 	 		7	4
-				 	-		 040411			

r0	r m	ajors in Fri	uit and V	egetable Grops	
HS	421,	Fruit Produc	tion		3
HS	432,	Vegetable Pro	duction		3
HS	562,	Post-Harvest	Physiology	3	3
		Electives			;

For majors in Floriculture, Nursery Management and Landscape Horticulture

 Credits

 HS 211, 212, Ornamental Plants

 6

 HS 301, Plant Propagation

 3

 HS 351, 441, 442, Greenhouse Management, Floriculture I and II

 or

 HS 342, 411, 471, Landscape Gardening, Nursery Management, Arboriculture

 9

 Electives

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 103, General and Qualitative Chemistry 4 GN 411, Principles of Genetics 3 SSC 200, Soils 4 Electives 7	
Departmental Requirements and Electives (26 Credits) Credit	!s
ENT 312, Economic Entomology 3 PP 315, Plant Diseases 3	i.
For majors in Fruit and Vegetable Crops Credit	ts
HS 421, Fruit Production 3 HS 432, Vegtable Production 3 HS 552, Growth of Horticultural Plants 3 HS 562, Post-Harvest Physiology 3 Electives 8	1
For majors in Floriculture, Nursery Management, and Landscape Horticulture	j- ts
HS 211, 212, Ornamental Plants6 HS 441, 442, Floriculture I and II6 or HS 411, 471, Nursery Management: Arboriculture6	ž.
Electives 8 Agricultural Technology—The requirements of the agricultural tech nology curriculum are as follows:	1-
Group A and B Courses (10 Credits)	te

во	421,	Plant	Physiology	4
GN	411,	Geneti	i cs	
PP	315,	Plant	Diseases	

Group C Courses (11 Credits)

a 1	9 2 3 8	an an Alba an	Credits
SSC 341, Soil Fertility and Fertilizers			
HS 481, Breeding of Horticultural Plants			
Electives	а,		
Departmental Requirements and Electives (27 Credits)			Credits
ENT 312, Economic Entomology			3 6
For Majors in Fruit and Vegetable Crops	2]1]1		a ¹⁹⁴² A a ⁶ A
ACC ACL Manhating of Fruits and Veretables	• • •	н (12) н	Credits
AGC 364, Marketing of Fluits and Vegetables		·	3
HS 439 Vegetable Production			· 3
HS 552, Growth of Horticultural Plants			
HS 562, Post-Harvest Physiology			3
Electives		••••••	

Credits

For majors in Floriculture, Nursery Management, and Landscape Horticulture

			560,0,00 <u>50</u> ,751
HS	S 211, 212, Ornamental P	lants	6
HS	S 301, Plant Propagation		3
HS	S 351, 441, 442, Greenhous	se Management; Floriculture I and II	3
	or		
HS	S 342, 411, 471, Landscape	Gardening, Nursery Management, Arboriculture	9

Graduate Study

The Department of Horticultural Science 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.

Department of Plant Pathology

Professor D. E. ELLIS, Head of the Department

TEACHING AND RESEARCH

Professors:

ROBERT AYCOCK, C. N. CLAYTON, F. A. HAASIS, T. T. HEBERT, A. KELMAN, E. L. MOORE, L. W. NIELSEN, C. J. NUSBAUM, N. N. WINSTEAD Associate Professors:

J. L. APPLE, W. E. COOPER, D. M. KLINE, G. B. LUCAS, R. R. NELSON, L. H. PERSON, N. T. POWELL, J. P. ROSS, J. N. SASSER, R. T. SHERWOOD, HEDWIG TRIANTAPHYLLOU

Assistant Professors:

C. S. HODGES, D. L. STRIDER EXTENSION Professor Howard R. GARRISS, In Charge

Professors:

FURNEY A. TODD, J. C. WELLS

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 crop science, horticultural science, 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 offers 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 degrees 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, Crop Science, and Plant Pathology.

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

ulum.

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.

For the freshman year and basic requirements see pages 54 and 56.

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

Group A and B Courses (9-12 Credits)

Credits

СН	425,	Organic	Chen	nistry		·	3
CH	426,	Organic	Chen	istry			
8 · · ·			or				~
CH	451,	Introdu	ctory	Bioch	emistry	·	3
GN	411,	The Pr	inciple	es of	Genetics		2 2
		Electives					,

Group C Courses (9-12 Credits)

CS 211, Field Crops I	3
HS 201, Principles of Horticulture	
Electives	3-6

Departmental Requirements and Electives (27 Credits)

	Credits
BO 421, Plant Physiology	
BO 312, General Bacteriology	
ENT 312, Economic Entomology	
Entomology Elective	
PP 315, Plant Diseases	
Plant Pathology Elective	
CS 414, Weeds and Their Control	
Electives	

Department of Poultry Science

Professor H. W. GARREN, Head of the Department TEACHING AND RESEARCH
Professors:
C. W. BARBER, F. R. CRAIG, E. W. GLAZENER, C. H. HILL, M. R. KARE
Associate Professors:
T. T. BROWN, W. L. BLOW, J. W. KELLY
Assistant Professors:
E. E. BERNARD, F. W. COOK, W. E. DONALDSON, G. A. MARTIN
EXTENSION
Professor C. F. PARRISH, In Charge
Professor:
J. R. HARRIS
Associate Professors:
W. G. ANDREWS, H. L. BUMGARDNER, W. C. MILLS, JR., T. B. MORRIS
The Department of Poultry Science provides training in the principles

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

Through teaching, research, and extension the department serves students, poultrymen, and allied industries. The production of poultry has expanded rapidly in recent years to become one of the most important commodities in North Carolina.

The Department of Poultry Science is located in Scott Hall.

Opportunities

The expanding poultry industry in North Carolina and elsewhere has created more specialized positions than can be filled with the available poultry graduates. Job opportunities are varied, enabling the student to select the type of position having the greatest appeal to him. Graduates hold positions as managers and field representatives for feed manufacturers, processors, hatcheries, equipment companies, biological supply houses, banks, and other allied industries. They also work in communications and public relations and as teaching, extension and research specialists. A number of graduates have established their own successful 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.

For the freshman year and basic requirements see pages 54-56.

Agricultural Business-The requirements of the agricultural business curriculum are as follows:

Group A and C Courses (8 Credits)

CH 103, General Chemistry II ______ 4 CH 220, Introductory 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
 4

 Agricultural science
 4

 Po 403, Poultry Seminar
 4

 Po 404, Poultry Products
 3

 Po 521, Poultry Nutrition
 3

 Po 301, Animal Physiology
 4

 Agricultural Science
 5

 Po 301, Animal Science
 5

 Po 301, Poultry Science
 5

 Po 301, Poultry Science
 5

 Po 301, Poultry Science
 5

 Poultry Science
 5

 Poultry Science
 5

 Poultry Science
 5

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Group A Courses (26 Credits)

 BO 312, General Bacteriology
 4

 CH 221, Organic Chemistry
 4

 GN 411, The Principles of Genetics
 3

 ZO 301, Animal Physiology
 4

 *Electives
 11

Departmental Requirements and Electives (26 Credits)

DO 001 Devilant Due devetion

Credits

Credits

. .

Credits

625 - 240

Credits

PO	201, P	oultry	Production		ŧ.
PO	401, P	Poultry	Diseases _	4	2
PO	403, P	Poultry	Seminar _	1+1	l.
PO	404, P	Poultry	Products	3	l.
PO	52 0, P	Poultry	Breeding	9	5
PO	521, P	Poultry	Nutrition		Į.
PO	52 2, 1	Endocri	nology of t	he Fowl 3	ł
ZO	561, A	Animal	Embryolog	y <u> </u>	5

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

Group A and B Courses (15 Credits)

CH 220, Introductory Organic Chemi	stry
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or

CH	221,	rganic Chemistry	4
ZO	301,	nimal Physiology	4
GN	411,	he Principles of Genetics	3
BO	312,	eneral Bacteriology	4

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

Credits

Cradita

:

Group C Courses (10 Credits)

	Electives		10
		Departmental Requirements and Electives (25 Credits)	
PO	201, Poultry	Production	
PO	301, Poultry	Quality Evaluations	2
PO	401, Poultry	Diseases	4
PO	402, Commer	cial Poultry Enterprises	
PO	403, Poultry	Seminar	1+1
PO	404, Poultry	Products	
PO	520, Poultry	Breeding	
PO	521, Poultry	Nutrition	

Graduate Study

An extensive research program is found in the Department of Poultry Science. Graduate training is available in nutrition, physiology, and genetics. If the student desires, a research problem can be developed in one of these areas with disease as an additional consideration. This department houses one of the foremost laboratories in the country devoted to the nutritional aspects of disease resistance and susceptibility. In the physiology area is found the leading laboratory in this country for studying the mechanism of taste in domestic animals. The genetics area enjoys a national reputation for its outstanding contributions to the science of poultry genetics. Graduate study can be developed in either physiological or population genetics.

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, eight North Carolina students are selected each year to attend the University of Georgia and six 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 if three years were spent in pre-veterinary curriculum.

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.

90 The General Catalog

Languages (9 Credits)

Credits

ENG	111,	112,	English	Co	mposition	6
	E	nglis	sh Elec	tive		 3

Social Sciences and Humanities (6 Credits)

HI 2	261,	The U.S. in Western	Civilization	3
PS 2	201,	American Government	System	3

Physical and Biological Sciences (41 to 44 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 221, 223, Organic Chemistry I and II	_ 8
PY 211, 212, General Physics	8
or	or
PY 221, College Physics	_ 5
BO 103, General Botany	. 4
ZO 103, General Zoology	- 4
ZO 223, Comparative Anatomy	_ 4

Group C Courses (12 Credits)

ANS 201. Elements of Dairy Science	4
ANS 202, Fundamentals of Animal Husbandry	4
PO 201, Poultry Production	4

Department of Rural Sociology

Professor SELZ C. MAYO, Head of the Department TEACHING AND RESEARCH Reynolds Professor: C. HORACE HAMILTON Associate Professor: GLENN C. MCCANN Assistant Professor: JAMES N. YOUNG

EXTENSION

Professor JOHN W. CRAWFORD, In Charge of Community Development Associate Professor:

C. PAUL MARSH

Assistant Professors:

THOMAS N. HOBGOOD, ROBERT W. LONG

Instructors:

JOHN N. COLLINS, JANE U. NORWOOD

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.

For the freshman year and basic requirements see pages 54 and 55.

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

Group A Courses (26 Credits)

		Credits
ST 311, Introduction to Statistics	* .	3
Or GN 301. Genetics in Human Affairs	8. ¥	9
MIG 120, Physical Geology *Electives		3 3 17

Departmental Requirements and Electives (26 Credits)

Credits

SOC 202, Principles of Sociology	
RS 301, Sociology of Rural Life	
SOC 301, Human Behavior	
ANT 252, Cultural Anthropology	
RS 321, Introduction to Social Research	
or	
SOC 416, Research Methods	
RS 442, Rural Social Structure	
or	
SOC 511, Social Theory	
Electives	

Graduate Study

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

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

phy degree are required to take approximately 15 semester hours in the Department of Sociology at the University of North Carolina, Chapel Hill. 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.

Department of Soil Science

Professor JAMES WALTER FITTS, Head of the Department

TEACHING AND RESEARCH

Professors:

WILLIAM VICTOR BARTHOLOMEW, JAMES FULTON LUTZ, RALPH JOSEPH MCCRACKEN, WILLIE GARLAND WOLTZ, WILLIAM WALTON WOODHOUSE, JR.

Associate Professors:

CHARLES B. DAVEY, HOMER CLIFTON FOLKS, WILLIAM ADDISON JACKSON, EUGENE JOHN KAM-PRATH, CHARLES BERNARD MCCANTS, JAMES RODNEY PILAND, PRESTON HARDING REID, JAMES MAURICE SPAIN, RICHARD JAMES VOLK, STERLING BARG WEED, SANFORD EUGENE YOUNTS

Assistant Professors:

MAURICE GAYLE COOK, FREDERICK RUSSELL COX, DORIS LEE CRAIG, GEORGE AUGUST CUM-MINGS, EUGENE FRIZZELLE GOLDSTON, ROBERT EDMUND MCCOLLUM, RAYMOND J. MILLER, JAMES EDWARD SHELTON

.

Instructors:

CARLOS PAUL BICKFORD, CHARLES BENNETT ENGLAND, RALPH AVERY LEONARD EXTENSION

Professor EMERSON R. COLLINS, In Charge of Agronomy

Assistant Professor:

WILLIAM CALVIN WHITE

Assistant Professors:

J. FRANK DOCGETT, CLIFFORD K. MARTIN

The primary objective of the Department of Soil Science is to train students in the fundamental principles of soils, their 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 Soil Science is housed in Williams Hall.

Opportunities

Soil Science 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.

Credits

Undergraduate Curriculum

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

For the freshman year and basic requirements see pages 54-56.

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

 SSC 200, Soils
 4

 SSC 341, Soil Fertility and Fertilizers
 3

 SSC 302, Soils and Plant Growth
 3

 SSC 480, Senior Seminar
 1

 SSC 461, Soil Conservation and Management
 3

 SSC 452, Soil Classification
 3

 Electives
 6

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

Group A Courses (26 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)

	Gredit
CH Chemistry	
SSC 200, Soils	4
SSC 480, Senior Seminar	1
SSC 341, Soil Fertility and Fertilizers	3
SSC 302, Soils and Plant Growth	3
Select two of the following courses:	
SSC 461, Soils Conservation and Management	
SSC 452, Soil Classification	

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

Group A and B Courses (9-12 Credits)

Electives _____9-12

* May be elected from Groups B and C.

Departmental Requirements and Electives (27 Credits)

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

Graduate Study

The Department of Soil Science 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.

Department of Zoology

Professor F. S. BARKALOW, JR., Head of the Department TEACHING AND RESEARCH
Professors:

R. HARKEMA, M. R. KARE, T. L. QUAY, R. W. STACY

Associate Professors:

W. W. HASSLER, G. C. MILLER, J. A. SANTOLUCITO

Assistant Professors:

C. W. ALLISTON, F. E. HESTER

Instructors:

GEORGETTE CAMPBELL, F. L. ROBERTS

EXTENSION
Assistant Professor H. M. FIELDS, In Charge of Wildlife

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.

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.

For the freshman year and basic requirements see pages 54 and 55.

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

Language (3 Credits)

ENG 231, Basic Speaking Skills _____ 3

Group A Courses (21-24 Credits)

ZO 205, Invertebrate Zoology		4	
ZO 206, Vertebrate Zoology		4	
One course in Botany	2 0	r	3
One course in Entomology		3	
One course in Organic Chemistry		3	
Electives (from Botany, Chemistry, Soil Science, Geology, Entomology, Genetics,			
Mathematics and/or Statistics)	2 0	r ·	4
*Electives		3	•

Departmental Requirements and Electives (29 Credits)

ZO 223. Comparative Anatomy

,	domparative rinatomy	4
301,	Animal Physiology	4
321,	Wildlife and Natural Resource Conservation	3
522,	Animal Ecology	3
520,	Fishery Science	3
551,	Wildlife Science	3
521,	Fishery Science	
	or	
552,	Wildlife Science	3
	Advised Electives	6
	301, 321, 522, 520, 551, 521, 552,	301, Animal Physiology 321, Wildlife and Natural Resource Conservation 522, Animal Ecology 520, Fishery Science 551, Wildlife Science 521, Fishery Science or 552, Wildlife Science Advised Electives

Undergraduate Curriculum—Zoology

The degree of Bachelor of Science with a major in zoology is offered under the agricultural science curriculum.

For the freshman year and basic requirements see pages 54 and 55.

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

^{*} May be elected from Groups B and C.

Languages (3 Credits)

Credits

ENG 231, Basic Speaking Skills	
--------------------------------	--

Group A Courses (26 Credits)

ΖO	301,	Animal Phy	siology .				е <u>.</u>	4
zo	223,	Comparative	Anatom	у			 	
		Restricted 1	Electives	from Group	Α		 	
	2	Restricted E	Electives f	from Groups	A, B, a	nd/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. Graduate programs are offered which include course work at Duke University and at the Duke Marine Laboratory.

The North Carolina Agricultural Institute

H. BROOKS JAMES, Dean of Agriculture EDWARD 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.

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, instruction offered by the Agricultural Institute is designed to train men and women for those jobs in agriculture that require technicians with education beyond the high school level. An individual with this type of training should have a better income, assume a more prominent role of leadership, 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 is 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.

Program of Study

The seven programs of study offered are farm machinery sales and service, general agriculture, livestock management and technology, poultry technology, pest control, ornamental crops technology, and field crop technology.

The Agricultural Experiment Station

H. BROOKS 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.

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 greenhouse and laboratories of the College and throughout the State on areas owned by farmers on 16 strategically located experimental farms and on farms rented for short periods.

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

The Agricultural Experiment Station staff brings to the College many experts, whose teaching in many specialized fields of agriculture assures the maintenance of curricula of high standards. It contributes much to the advanced training of students who are destined to become the leaders, teachers, and investigators necessary in the maintenance of agriculture on sound and economic planes.

Publications

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

Services

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

Cooperative Agricultural Extension Work

H. BROOKS JAMES, Dean of Agriculture
R. W. SHOFFNER, Director of Extension
I. O. SCHAUB, Director Emeritus of Extension
DAVID S. WEAVER, Director Emeritus 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 supported by federal funds derived from the Smith-Lever Act of 1914, the Capper-Ketcham Act of 1928, the Bankhead-Jones Act of 1935, the Bankhead-Flannagan Act of 1945, and by State and county appropriations. Federal and State appropriations are used to maintain an administrative and specialist staff and to supplement salaries and travel expenses of county extension agents, who are located at each county seat in the State.

Objectives

The purpose of the Extension Service is to take to the rural people of North Carolina the latest and best information obtainable for building a more prospersous 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 of charge. In addition, it holds a number of short courses, both on the College campus and elsewhere throughout the State, to offer rural leaders advice and training in creating better homes and farms and in using more efficient farming practices.



School Of Design

HENRY L. KAMPHOEFNER, Dean

The School of Design 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 in the construction of shelter. Therefore, the school gives attention to the larger responsibility of architecture, the art of humanizing the environment. Also, the school seeks to integrate the architect as a social human being and the architect as scientist-engineer, and encourages and nurtures the architectengineer as the coordinator of the structural dynamics in the over-all pattern of life.

While the School of Design's first aim is to serve North Carolina and the regions of the South, the students are well 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, the school fosters and cultivates the integrity of the individual.

The School of Design emphasizes individual creative expression and at the same time teamwork is encouraged and developed.

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. The school has brought together creative personalities willing in their teaching to subordinate their own professional interests to the interests of their students. Each School of Design faculty member gives the young student the benefit of his professional knowledge, his technical training, and his experience as a citizen. To combat the dangers of over-specialization the school seeks to develop the personality and character of the student 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 re-

quirements 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.

The School of Design is comprised of the Departments of Architecture, Landscape Architecture, and Product Design.

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.

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 increasingly combine these studies 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, 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. The new Brooks Hall is a remodeling of 28,000 square feet of floor space and a new addition of 20,000 square feet. All of the facilities of the school are now in modern, especially designed quarters under one roof.

Opportunities

State law now requires the graduate architect to work not less than three years in the offices of registered architects and to pass the four day written examination given by the North Carolina Board of Architecture before he is ready to begin 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.

The accelerated urban growth of the twentieth century has created an unprecedented demand for landscape architects that far exceeds the production of schools. These positions exist in both public and private organizations, encompassing a range of interests from city and regional planning to residential developments. For the competent graduate advancement is rapid, and remuneration above average.

Evidence of the soundness of the course of study and the programs in design at North Carolina State College is reflected by two of the school's recent graduates who have been awarded the Fellowship in Landscape Architecture to the American Academy in Rome—a prize awarded annually to any design graduate in the United States and affording two years of advanced study in Europe, providing all expenses and residence at the American Academy in Rome. Four 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 Department of Product Design, which took its first students in September 1958, prepares graduates to work as resident designers with the furniture manufacturers and other essential and important industries of the State. Graduates of the department will also be qualified to establish offices as professional industrial designers in the major cities of the State.

Department of Architecture

Professors:

HARWELL H. HARRIS, DUNCAN R. STUART

Associate Professors:

JOSEPH N. BOAZ, JOSEPH H. COX, JERZY GLOWCZEWSKI, CHARLES H. KAHN, EDWARD W. WAUGH

Assistant Professors:

GEORGE L. BIRELINE, PAUL BUISSON, JOHN HERTZMAN, CHARLES M. SAPPENFIELD, VERNON SHOGREN, BRIAN SHAWCROFT, E. WAYNE TAYLOR, RICHARD S. WURMAN

Instructors:

D. GRANT JOSLIN, WILLIAM C. NICHOLS Librarian:

MRS. JAMES A. LYONS

Architecture demands a fusion of the artist's decision with competent technical judgments. If it is good architecture, the design must be the product of creative insight into the meaning of the building as an object defining spaces, and must also embody an artistic declaration of the building's meaning to men and to their advancement. At the same time architecture must be technologically feasible and economically sound, and the form and spirit of the design must survive and be strengthened by the

lengthy and complicated methods by which it is transformed into a building. Good architecture does not acknowledge that the conception of a design and its execution are opposed to each other. Instead, it joins the two so that they are realized in a single act, and subjective and conceptual choices are based on a clear and complete understanding of reality.

The training of architects must stir in them the realization that technical skill is meaningless without a guiding purpose and that practical problems they face need not be opposed to their dreams and ambitions. In arts and letters the student must learn and value the purpose of architecture; in science and engineering he must learn the principles that challenge or limit him; and in his study of architecture he must learn the fusion of science and art in buildings. Four parallel programs (architecture, art, humanities and social sciences, and science and engineering) occupy the student throughout his program of study. After its completion the student is not merely ready for the apprenticeship that precedes his becoming a qualified architect. He is prepared to ponder and evaluate the things he learns during his apprenticeship and the things he learns as his self-education continues. Thus, he can combine the practical reguirements of the working profession of architecture with the even more practical desire to realize the full meaning of his profession.

Architecture Curriculum

First Year

Fall Semester Cr	edits
DN 101, Design I	3
DN 111, Descriptive Drawing I	2
DN 121, Technical Drawing I	3
ENG 111, Composition	. 3
MA 101, Algebra and Trigonometry	5
MS 101, Military Science I	
or	
AS 121, Air Science I	. 1
PE 101, Physical Education	. 1

Spring Semester	Credit
DN 102, Design II	
DN 112, Descriptive Drawing II	
DN 122, Technical Drawing II	
ENG 112, Composition	
MA 102, Analytic Geometry and	
Calculus I	4
MS 102, Military Science I	
or	5×.
AC 100 Aim Colonge T	1

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PE	102.	Phy	vsical	Edu	cation	

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Second Year

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Fall Semester Cr	edits
ARC 201, Architectural Design I	. 4
DN 211, Descriptive Drawing III	. 2
HI 245, European Civilization	. 3
MA 201, Analytic Geometry and	21
Calculus II	. 4
PY 211, General Physics	4
MS 201, Military Science II	
or	
AS 221, Air Science II	. 1
PE 201, Physical Education	. 1

Spring Semester Cro	edits
ARC 202, Architectural Design II	4
DN 212, Descriptive Drawing IV	2
EM 200, Introduction to Mechanics	3
HI 246, European Civilization	3
PY 212, General Physics	4
MS 202, Military Science II	
or	
AS 222, Air Science II	1
PE 202, Physical Education	1

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Summer Requirement

Two weeks on Historic Architecture Research-Field Work

Third Year

Fall Semester	Gredits	Fall Semester	Credits
ARC 301, Architectural Design I	II 6	ARC 300, Historic Architecture	
CE 338, Structures I	4	Research	2
DN 311, Advanced Descriptive		ARC 302, Architectural Design IV	6
Drawing I	2	ARC 312, Materials and Specification	ons 3
DN 321, History of Architecture	I 3	CE 339, Structures II	4
EM 301, Solid Mechanics I		DN 312, Advanced Descriptive	
*Elective		Drawing II	
		DN 322, History of Architecture II	I 3
	21	• • • • • • • • • • • • • • • • • • •	
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Summer Requirement

Ten weeks on approved construction or office project experience.

Fourth Year

Fall Semester	Credits	Spring Semester	Credits
ARC 377, Environmental Factors ARC 401, Architectural Design ARC 421, Structural Design I DN 411, Advanced Descriptive	V 3 V 6 3	ARC 378, Environmental Fa ARC 402, Architectural Des ARC 422, Structural Design DN 412, Advanced Descripti	ctors 3 ign VI 6 II 3
Drawing III	2	Drawing IV	2
DN 421, History of Design I	3	DN 422, History of Design 1	I 3
*Elective	3	*Elective	

Fifth Year

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

^{*} Six credits of elective will be required in the literature of English and three in the social sciences. The remaining 10 hours shall be free electives. (Total credits for Bachelor of Architecture—190.)

Department of Landscape Architecture

Associate Professor RICHARD A. MOORE, Head of the Department Professors:

LEWIS J. CLARKE, EDWIN G. THURLOW, DUNCAN R. STUART Associate Professor:

JOSEPH H. COX

Assistant Professors:

GEORGE L. BIRELINE, JOHN HERTZMAN

Instructor:

D. GRANT JOSLIN

Landscape architecture, beginning in ancient times, is now defined as the design of outdoor space for the benefit, protection, use and enjoyment of people. Never before have the challenges to this profession been so great, diverse, and complex. It is to their solutions that this department is directed. One such challenge is the design of landscapes with architectural character and scale, such as those associated with the city, town, park, and garden. Another challenge is the designed development of the earth's resources in landscapes of varying character, from coast to mountain, from desert to pasture. Unlike many art forms time is an essence of the design, and long periods are often necessary before it has grown to completion. Architectural and engineering materials are used together with plants and trees. These latter materials have a continuous cycle of growth and movement, closely coupled with the forces of nature. The profession is both an art and a science, depending at the same time upon logic and technology.

A student in the department is associated with allied fields such as architecture, engineering, painting, sculpture, horticulture, botany, geology, and ecology. In spite of the necessity for assimilation of such specialized requirements, he must possess a background from which to design. For this reason he is given a sound and thorough analysis of the past through the study of historical examples. With the rapid growth of the world's population and the increasingly intensive use of land, it is imperative that the student have both ability and clarity of purpose if he is to develop and design landscape solutions that are beautiful, useful, productive, and of continuing value.

Landscape Architecture Curriculum

First Year

Fall Semester	Credits
DN 101, Design I	
DN 111, Descriptive Drawing I _	2
DN 121, Technical Drawing I	3
ENG 111, Composition	
MA 101, Algebra and Trigonome	try 5
MS 101, Military Science I	
or	
AS 121, Air Science I	1
PE 101, Physical Education	1
	18

Spring Semester	Credits
DN 102, Design II	3
DN 112, Descriptive Drawing II	2
DN 122, Technical Drawing II	3
ENG 112, Composition	3
MA 102, Analytic Geometry and	742
Calculus I	4
MS 102, Military Science I	
or	
AS 122, Air Science I	1
PE 102, Physical Education	1

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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		MIG 120, Physical Geology	3
PY 211, General Physics		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 Historic Architecture or Landscape Architecture Research-Field Work.

Third Year

Fall Semester	Credits	Spring Semester	Credits
DN 311, Advanced Descriptive		ARC 300, Historic Architecture	
Drawing I	2	Research	2
DN 321, History of Architecture I	3	DN 312, Advanced Descriptive	
HS 211, Ornamental Plants	3	Drawing II	2
LA 301, Landscape Design I	5	DN 322, History of Architecture II _	3
LA 311, Landscape Construction	4	HS 212, Ornamental Plants	3
*Elective		LA 302, Landscape Design II	5
		LA 312, Landscape Construction	4
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Summer Requirement

Ten weeks on approved construction or office project experience.

Fourth Year

BO 441, Plant Ecology 3	Spring Semester	Credits
DN 411, Advanced Descriptive	DN 412, Advanced Descriptive	
Drawing III 2	Drawing IV	2
DN 421, History of Design I 3	DN 422, History of Design II _	

T 1 (01 D1 1 D 1	
LA 421, Planting Design4	
*Elective 3	

21

LA 402, Landscape Design IV _____ 6 LA 422, Planting Design _____ 4 *Electives _____ 6

21

Fifth Year

Fall Semester	Credits	Spring Semester	Credits
DN 511, Advanced Descript	ive	DN 512, Advanced Descriptive	
Drawing V		Drawing VI	2
DN 541, Seminar on Ideas	in Design 2	LA 502, Landscape Design VI	
LA 501, Landscape Design	V 6	PHI 306, Philosophy of Art	3
LA 511, Landscape Constru	ction and	*Electives	6
Professional Practi	ce 4		
*Electives			19
	18		

^{*} Six credits will be required in the literature of English and six in the social sciences. The remaining 10 hours shall be free electives. (Total credits for the Bachelor of Landscape Architecture—190.)
Department of Product Design

Associate Professor VICTOR J. PAPANEK, Head of the Department Professor:

DUNCAN R. STUART Associate Professor:

JOSEPH H. COX

Assistant Professors:

WILLIAM J. BARON, GEORGE L. BIRELINE, JOHN HERTZMAN, CLARK MACOMBER Instructor:

D. GRANT JOSLIN

Product design (or industrial design) has most often been associated with the appearance value and other sensory attributes of mass-produced products of every description. It is relatively new as a profession, dating back to the early thirties, when early attempts at "styling" helped to sell consumer goods in a depressed market. Today the designer's influence has spread to almost every object we buy or use in daily life, from transportation and farm machinery to household appliances, furniture, office equipment, hardware, and toys.

Students in the Department of Product Design search for new ways to solve product problems, questioning prosaic solutions, and employing their understanding of materials and techniques at a high level of creative activity. New products and functional improvements are developed in the design laboratory and described in models, sketches, and engineering drawings. The student includes a summary of production requirements, cost estimates, distribution methods, packaging ideas and other pertinent information required to make his reports inclusive of all the skills developed at the school, in simulation of the product problem. The profession requires exceptional creative ability, coupled with sound judgment for the responsibilities implicit in design for large scale consumption. There are few areas more rewarding economically, or in the personal satisfaction of design for human need.

Product Design Curriculum

First Year

Fall Semester	Credits
DN 101, Design I	3
DN 111, Descriptive Drawing I	2
DN 121, Technical Drawing I	3
ENG 111, Composition	3
MA 101, Algebra and Trigonometry	5
MS 101, Military Science I	2
or	
AS 121, Air Science I	1
PE 101, Physical Education	1
	18

Spring Semester	Credits
DN 102, Design II	
DN 112, Descriptive Drawing 11 _	2
DN 122, Technical Drawing II	
ENG 112, Composition	
MA 102, Analytic Geometry and	
Calculus I	4
MS 102, Military Science I	ζ.
or	4
AS 122, Air Science I	1
PE 102, Physical Education	1
San Magir •	
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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		PD 202, Product Design and Orientation	on 4
Calculus II	4	PSY 200, Introduction to Psychology	
PD 201, Product Design and Orien	tation 4	PY 212, General Physics	4
PY 211, General Physics	4	MS 202, Military Science II	
MS 201, Military Science II		or	
or		AS 222, Air Science II	1
AS 122, Air Science II	1	PE 202, Physical Education	1
PE 201, Physical Education			
			19
	20		

Third Year

Fall	Semester	Credits	Spring Semester	Credits
CH DN	101, General Chemistry I 311, Advanced Descriptive	4	CH 103, General Chemistry II DN 312, Advanced Descriptive	4
EC EM PD	Drawing I 425, Industrial Management 200, Introduction To Mechanics 301, Product Design	2 3 3 6	Drawing II EM 301, Solid Mechanics PD 302, Product Design PD 332, Materials and Processes	2 3 6 3
PD	331, Materials and Processes	3 21	Elective	3 21

Fourth Year

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

19

Fifth Year

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

* Six credits will be required in the literature of English and six in the social sciences. The remaining 10 hours shall be free electives. (Total credits for the Bachelor of Product Design—190.)



School Of Education

J. BRYANT KIRKLAND, Dean

With the current and anticipated increase in the number of secondary school age boys and girls in North Carolina, it is necessary for the educational institutions of the State to prepare a greater number of students to be teachers in the public schools. There is a particular need for teachers in the areas of vocational agriculture, industrial arts, industrial education, mathematics and science.

The School of Education graduates students who are qualified for teaching positions in these areas.

The school includes the Departments of Agricultural Education, Industrial Arts, Industrial Education, Mathematics and Science Education, Occupational Information and Guidance, Psychology, and Recreation and Park Administration.

Objectives

The primary purpose of the Departments of Agricultural Education, Industrial Arts, Industrial Education, Mathematics and Science Education is to prepare students to become teachers in the North Carolina 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 area. The curriculum in the Department of Recreation and Park Administration is designed primarily to prepare students to become leaders of recreation programs in industry, institutions, and municipalities.

The Departments of Psychology and Occupational Information and Guidance offer professional instruction at the graduate level for psychologists and vocational counselors. In addition, these departments provide service courses for undergraduate students in the School of Education and the other schools of the College.

Opportunities

Agricultural education graduates find jobs as teachers of vocational agriculture in which they conduct organized instructional programs of vocational agriculture for rural young people and adults.

Public schools employ competent industrial arts and industrial education teachers whose job is to familiarize the young people of the State, particular those in the non-farm areas, with the available occupational opportunities which accompany an industrial expansion and to train these young people for entrance into the industrial occupations of their choice.

Graduates in the Department of Recreation and Park Administration secure jobs as recreational leaders for municipalities, industries and institutions while Department of Mathematics and Science graduates find jobs in public schools and industry. Students trained in the Department of Occupational Information and Guidance are employed by public schools as teachers and vocational counselors.

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.

Degrees

The Bachelor of Science in Education is awarded to the students who complete the curricula in Agricultural Education, Industrial Arts Education, Industrial Education, Mathematics Education and Science Education.

The School of Education also offers the Bachelor of Science in Recreation and Park Administration and the Bachelor of Science in Industrial Arts for those students pursuing the technical option curriculum.

The degree of Master of Education or the Master of Science in Education is offered to students majoring in Agricultural Education, Industrial Education, Industrial Arts Education and Guidance. The degree of Master of Science in Psychology is also offered.

Department of Agricultural Education

Professor C. C. SCARBOROUGH, Head of the Department Professor Emeriti: L. O. ARMSTRONG, J. K. COGGIN Professor: J. BRYANT KIRKLAND Adjunct Professor: G. B. JAMES Research Associate Professor: L. W. DRABICK

Assistant Professors:

T. R. MILLER, H. E. BEAM Instructors:

C. D. BRYANT, C. H. ROGERS

The program in agricultural education is concerned with two large areas of study-education and agriculture. It is imperative that the objectives which give major direction to the program be clearly understood. People who produce, market, and/or process agricultural commodities are in a highly technical field. Emphasis is placed upon agriculture, agricultural products and processes. The education of people who plan to educate others in the area of agriculture is somewhat different. The objectives here are educational objectives. Agricultural objectives deal with agriculture-the improvement of crops, livestock, soils, and the like. Educational objectives relate to people-bringing about growth development, and desirable change in people. The primary concern of agricultural education is with educational objectives. Agricultural education, in its broad sense, should encompass those areas of study and pursuit which would enable one to participate effectively in planning, promoting, and initiating educational programs in agriculture. Therefore, the description of a graduate in agricultural education would be more nearly an "educational leader" than an "agricultural specialist".

Every education leader as a person is a member of a family, a member of a community, a citizen (local, state, national, and international), and a professional worker. The experiences, understandings, and abilities needed by an educational leader are not gained through class work only. His home life, community life, dormitory and social life on the campus, all make contributions to his preparation for his work as an educational leader.

Undergraduate Program

The program in agricultural education includes education for personal development, for community living, for citizenship, for home living, and for educational leadership. These areas in the College program are divided into three groups:

- (1) general education
- (2) technical or special education
- (3) professional education

General education includes the education which everyone should have, namely, preparation for living effectively (1) with one's self, (2) with one's family, (3) in a community, (4) as a local, state, national, and world citizen, and (5) bringing to bear the knowledge of man in solving problems. The education of people should not differ fundamentally and widely in these areas.

Special, or technical education consists of securing an understanding and ability to solve agricultural problems, with emphasis upon managerial aspects. Particular attention is given to a consideration of the impact of these problems upon the people of North Carolina. That is, "facts and figures about agriculture" will not suffice as technical education for the educational leader. A knowledge and understanding of agriculture and the ability to identify agricultural problems, make decisions, and solve problems is essential. Professional education includes an understanding of human behavior and development. Particular attention is given to an understanding of the learning process—as it occurs and how it can be accelerated. Consideration is also given to understanding how people work together in groups, particularly in rural communities. Ability to do research in the community is essential.

Graduate Program

Qualified graduate students may secure a Master of Science in Education or Master of Education degree. Interested persons should see the Graduate Catalog or write to the Agricultural Education Department.

Facilities and Resources

In addition to the College facilities and resources, the administrative personnel of most of the agricultural agencies and programs have offices in Raleigh. These people often serve as valuable resource people to students in agricultural education.

*Agricultural Education Curriculum

Freshman Year

Fall Semester	Credits	Spring Semester	Credits
AG 103, Introduction to Agricultu	ıre 1	AGE 201, Agricultural Construction	
BO 103, General Botany	4	and Maintenance I	2
ED 102, Objectives in Agricultur	al	Agriculture Elective	3
Education		ENG 122, Composition	3
ENG 111, Composition		Math Elective	4
MA 111, Algebra and Trigonome	try 4	ZO 103, General Zoology	4
MS 101, Military Science I	and a second	MS 102, Military Science I	3
or		or	×
AS 121, Air Science I		AS 122, Air Science I	1
PE 101, Physical Education	1	PE 102, Physical Education	1
	15		18
			55

Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
AGE 202, Agricultural Construction		AGE 211, Farm Power and	
and Maintenance II	2	Machinery I	3
English Elective	3	AGC 212, Economics of Agriculture	3
CH 101, General Inorganic Chemistr	y _ 4	CH 203, General and	
PSY 200, Introduction to Psychology	у_3	Organic Chemistry	4
EC 201, Economics		ED 201, Farming Programs and FFA	2
MS 201, Military Science II		PSY 304, Educational Psychology	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 PE 202, Physical Education _____ 1

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Junior Year

Fall Semester

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Credits

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÷3	Management of Marketing
	Firms
ED 344	, Secondary Education
	History Elective
RS 301,	Sociology of Rural Life
SC 200), Soils
	Free Elective
14.	

Spring Semester	Credits
AGC 303, Organization and Busines Management of Farms	s 3
Agricultural Engineering	
Elective	3
ED 313, Teaching Rural People	2
ED 420, Principles of Guidance	2
English Elective	3
PSY 476, Psychology of Adolescence	2
Free Elective	3
	18

* A minimum of 137 semester credits required for graduation.

Senior Year

Fall Semester	Credits	Spring Semester	Credits
AGE 401, Problems in Farm M *ED 411, Student Teaching ED 412, Teaching Adults ED 413, Teaching Materials RS 321, Introduction to Social	lechanics 3 6 2 2 Research 3	Agriculture Electives Biological Science Elective Political Science Elective Free Electives	6 3 6
	-		18
	16		

Department of Industrial Arts

Professor IVAN HOSTETLER, Head of the Department Associate Professor:

TALMAGE B. YOUNG

Assistant Professors:

FRANK B. BRILEY, CARL A. MOELLER, ROBERT T. TROXLER

Instructor:

PAUL R. MEOSKY

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 problems related to these changes.

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.

Facilities

The Department of Industrial Arts is located in Tompkins Hall. Laboratory facilities are provided in drafting, woods, metals, electricity and electronics, graphic arts, and ceramics. In addition to these, a special experimental laboratory is provided in order to encourage experimentation and research in all of the industrial arts areas at the advanced undergraduate and graduate levels.

Opportunities

The opportunities for employment as industrial arts teachers in North Carolina are greater than ever before. The demand for 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 in Industrial Arts Education to do graduate work leading to the degree of Master of Education or Master of Science in Education. For additional information regarding graduate study, consult the Graduate School Catalog.

^{*} Summer Practice (1 week) is required prior to student teaching.

Industrial Arts Education Curriculum

Freshman Year

Fall Semester	Credits
ENG 111, Composition	3
IA 100, Introduction to Industrial Art	ts 1
IA 103, Dratting I	0 3
MA 111, Algebra and Trigonometry MS 101, Military Science I	4
AS 121, Air Science I	1
PE 101, Physical Education	1
	16

Spring Semester	Credits
ENG 112, Composition	3
IA 104, Drafting II	
IA 108, Woods II	3
MS 102, Military Science I	
or	
AS 122, Air Science I	1
PE 102, Physical Education	1
Mathematics Elective	4
	15

Sophomore Year

Fall Semester	Credits
CH 101, General Inorganic Chemistry IA 206, Metal Processing I PSY 200, Introduction to Psychology PY 211, General Physics MS 201 Military Science II	/ 4 3 3 4
or	
AS 221, Air Science II	1
PE 201, Physical Education	1
	16

Spring Semester (Credits
EC 205, Economic Process	3
ENG 231, Basic Speaking Skills	3
IA 207, Metal Processing II	3
PY 212, General Physics	4
SOC 202, Principles of Sociology	3
MS 201, Military Science II	
or	
AS 222, Air Science II	1
PE 202, Physical Education	1
	18

Junior Year

Fall Semester	Credits	Spring Semester	Credits
ED 344, Secondary Education	2 2	ED 422, Methods of Teaching Industrial Subjects	4
IA 205, Industrial Arts Design	3	IA 304, General Shop Organization	2 3
English Elective	3 3	PS 201, The American Govern-	0
History Elective	3 3	mental System PSV 476. Psychology of Adolescence	3 : 2

*Electiv	es 4
	-
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Senior Year

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

^{*} Twelve hours are to be technical electives; the remaining 10 hours are to be free electives.

Industrial Arts—Technical Option Curriculum

Freshman and sophomore years are the same as in industrial arts education.

Junior Year

Fall Semester	Credits	Spring Semester	Credits
IA 205, Industrial Arts Design .	2	IA 308, Basic Electronics	
IA 307, Basic Electricity		PSY 337, Industrial Psychology I _	
IE 310, Industrial Safety	2	SOC 301, Human Behavior	
IE 332, Motion and Time Study	/ 4	English Elective	3
PS 201, The American Govern-		History Elective	
mental Systems		*Elective	
*Elective			-
	-		18
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Senior Year

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

Department of Industrial Education

Professor DURWIN M. HANSON, Head of the Department Assistant Professor: FLOYD P. GEHRES

The Department of Industrial Education offers the only curriculum 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 or technical experience in the occupational area they wish to teach. The student who has not had this 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 technical schools and the parttime, or evening vocational classes. Graduates have no difficulty in obtaining employment as institutional teachers.

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

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 Education or Master of Science in Education degree in industrial education will also qualify one for a Graduate Certificate in North Carolina.

*Industrial Educational Curriculum

Fall Semester	Credits	Spring Semester Cr	edits
ED 100, Introduction to Indus	trial	History Elective	. 3
Education	2	ENG 112, Composition	. 3
ENG 111, Composition		MA 112, Analytic Geometry and Calculu	S
MA 111, Algebra and Trigono	metry 4	or	
CH 101, General Inorganic Ch	emistry _ 4	MA 122, Mathematics of Finance and	
IA 103, Drafting I	3	Elementary Statistics	- 4
MS 101, Military Science I		IA 104, Drafting II	_ 3
or		MS 102, Military Science I	
AS 121, Air Science I		or	
PE 101, Physical Education		AS 122, Air Science I	- 1
·		PE 102, Physical Education	- 1
	18		
			100

Freshman Year

Sophomore Year

Fall Semester	Credits	Spring Semester Cr	edits
PY 211, General Physics	4	PY 212, General Physics	- 4
ENG, English Elective	3	SOC 202, Principles of Sociology	- 3
PSY 200, Introduction to Psychology	_ 3	EC 205, Economic Process	- 3
PS 201, American Government System		MS 202, Military Science II	
MS 201, Military Science II	1	or	
or		AS 222, Air Science II	. 1
AS 221, Air Science II	1	PE 202, Physical Education	. 1
PE 201, Physical Education	1	**Elective	- 5
**Elective	3		

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	Jano	* Cul	
Fall Semester	Credits	Spring Semester	Credits
ED 344, Secondary Education	2	PSY 337, Industrial Psychology	
PSY 304, Educational Psycholog	gy 3	or	*: *
SOC 401, Human Relations in		PSY 476, Psychology of Adolesend	ce2-3
Industrial Society		ED 305, Analysis of Technical Ec	lucation
IE 310, Industrial Safety		Programs and Course	
ED 327, History and Philosoph	hy of	Constuction	3
Industrial-Technical B	Education 3	RPA 333, First Aid and Safety	2
**Elective		ED 422, Methods of Teaching	
		Industrial Subjects	
e e	18	English Elective	
		**Elective	
а ж.			•
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* Minimum of 136 Semester hours required for graduation.

** Fifteen hours of elective courses must be selected in accordance with the student's area of specialization and with approval of the adviser. Remaining hours may be taken from free electives.

Senior Year

Fall Semester	Credits	Spring Semester	Credits
ED 440, Vocational Education ED 483, Instructional Aids and Dev ED 405, Industrial and Technical cation Shop and Labora Planning	vices 2 Edu- tory	EC 425, Industrial Management EC 432, Industrial Relations ED 420, Principles of Guidance *Elective	3 3 2 8
ED 444, Student Teaching in Industrial Subjects *Elective	6 3-4	ж ж	16

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Department of Mathematics and Science Education

Associate Professor HERBERT E. SPEECE, Head of the Department Assistant Professor:

HENRY A. SHANNON

The Department of Mathematics and Science Education offers curricula for 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 requirments 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.

^{*} Fifteen hours of elective courses must be selected in accordance with the student's area of specilization and with approval of the adviser. Remaining hours may be taken from free electives.

***Mathematics Education Curriculum**

Freshman Year

Fall Semester	Credits	Spring Semester	Credits
CH 101, General Inorganic Che ENG 111, Composition	emistry _ 4 3	CH 103, General and Qualitative Chemistry	4 8
MA 101, Algebra and Trigonom	etry 5	MA 102, Analytic Geometry and Calculus I	4
AS 121, Air Science I	1	MA 122, Mathematics of Finance an Elementary Statistics	id 4
PE 101, Physical Education	1 	MS 102, Military Science I or	1
	17	AS 122, Air Science I PE 102, Physical Education	1

Sophomore Year

Fall Semester	Credits	Spring Semester
ED 203, Introduction to Teaching .	2	BO 103, General
MA 201, Calculus II	4	
PY 211, Physics	4	ZO 103, General
SOC 202. Principles of Sociology	3	MA 202, Calculu
MS 201. Military Science II		PY 212, Physics
or		MS 202, Military
AS 221. Air Science II	1	
PE 201. Physical Education	1	AS 222, Air Scie
PSY 200. Introduction to Psychology	y 3	PE 202, Physical
		Elective
	18	

Spring Semester	Credits
BO 103, General Botany or	
ZO 103, General Zoology	4
MA 202, Calculus III	4
PY 212, Physics	4
MS 202, Military Science II	
or	
AS 222, Air Science II	1
PE 202, Physical Education	1
Electives	

17

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Junior Year

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

P 31	304,	Education	nai i	sychology		5
		Electives				10
					-	

Senior Year

Fall Semester	Credits	Spring Semester	Gredits
ED 470, Methods of Teaching	Math 3 n Math 6	ED 420, Principles of Guidance MA 433. History of Math	2 3
ED 472, Developing and Select Teaching Materials in	ing Math 2	**Electives English Elective	9 3
PSY 476, Psychology of Adoles	cence 2		17
	13		

^{*} A minimum of 138 semester credits required for graduation. Beginning with the fall semester of 1965, MA 101 will not count toward graduation in mathematics education; however, MA 403 will be required.

^{**} A minimum of 9 semester hour electives in mathematics. All electives must be selected with approval of adviser.

^{***} During the fall semester of the Senior year 10 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	
MA 111, Algebra and Trigonom	etry 4	Calculus A	4
ENG 111, Composition	3	BO 103, General Botany	4
MS 101, Military Science I		ENG 112, Composition	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
		PE 102, Physical Education	1
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			17

Sophomore Year

Fall Semester Credits
BO 301, General Morphology
or
BO 403, Systematic Botany 3
CH 101, General Inorganic Chemistry _ 4
PS 201, The American Govern-
mental System 3
SOC 202, Principles of Sociology 3
MS 201, Military Science II
or
AS 221, Air Science II 1
PE 201, Physical Education 1
**Elective 3
18

Spring Semester	Credit
MIG 120, Physical Geology	3
CH 103, General and Qualitative Chemistry	4
ED 203, Introduction to Teaching _	2
ZO 213, Human Physiology	3
MS 202, Military Science II	
or	
AS 222, Air Science II	1
PE 202, Physical Education	1
**Electives	3
	17

Junior Year

Fall Semester	Credits
CH 203, General and Organic	
Chemistry	4
EC 205, The Economic Process	3
ED 344, Secondary Education	2
PY 211, Physics	4
English Elective	3

Spring Semester	Crcedits
PSY 304, Educational Psychology	
PY 212, Physics	
**Electives	11

******Electives

19

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Senior Year

Fall Semester	Credits	Spring Semester	Credits
ED 475, Methods of Teaching in		PY 223, Astronomy	3
Science	3	BO 312, General Bacteriology	4
***ED 476, Student Teaching in		ED 420, Principles of Guidance	2
Science	6	**Elective	6
ED 477, Developing and Selecting		English Elective	3
Teaching Materials in			
Science	2		18
PSY 476, Psychology of Adolescence	2		
	10		

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^{*} A minimum of 138 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 10 weeks will be devoted to full-time off-campus work at an approved Student Training Center and approximately 6 weeks to concentrated courses.

Department of Occupational Information and Guidance

Professor Roy N. Anderson, Head of the Department Associate Professor: CHARLES G. MOREHEAD

The Department of Occupational Information and Guidance has been training guidance and personnel workers for more than four decades. The first master's degree was awarded in 1926. The programs of graduate study are planned to develop a broad understanding of guidance and personnel services to be applied in various settings. It is most desirable for an applicant who wishes to specialize in guidance and personnel services to have had undergraduate course work in economics, education, psychology, sociology, or social work. Students accepted into the program are those who anticipate devoting full or part time to guidance and personnel work. Teachers, administrators and others who wish to increase their knowledge of guidance and personnel may enroll for courses as a graduate minor or for certification renewal.

Professional opportunities for placement in this field are on the increase. The department prepares students for positions as counselors in secondary schools, industrial education centers, colleges, community agencies; school or county guidance directors, rehabilitation counselors, employment counselors, placement interviewers, and personnel workers in higher education, business or industry, and State and Federal government agencies. The student may specialize in one of several areas depending upon his vocational goals.

The master's program includes a core of guidance and personnel courses to be selected according to the student's vocational goals. Students may select their minor from the following areas—economics, psychology, sociology and anthropology. The master's degree program of the department meets the requirements for the Counselor's Certificate issued by the North Carolina State Department of Public Instruction, as well as counselor certification in many other states.

The Department of Occupational Information and Guidance has had a contract with the Office of Vocational Rehabilitation for the training of rehabilitation counselors, and has been awarded four Counseling and Guidance Training Institutes under contract with the United States Office of Education as authorized by the National Defense Education Act of 1958.

The department also provides service courses in guidance and personnel for undergraduate students in the School of Education.

Department of Psychology

Professor Howard G. Miller, Head of the Department Professors: Key L. Barkley, Harold M. Corter Associate Professors: NORMAN M. CHANSKY, JOHN O. COOK, J. CLYDE JOHNSON, SLATER E. NEWMAN, PAUL J. RUST Assistant Professors: EUGENE E. BERNARD, DONALD W. DREWES Adjunct Assistant Professor: GILBERT GOTTLIEB Instructor: JAMES B. GRIER

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 of the College.

Graduate Study

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

Department of Recreation and Park Administration

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

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. All students pursue the same program for the first year after which they declare an option (employee, public, institutional recreation or park administration) and take courses designed to meet the needs in their respective area of interest.

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. 3 1

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***Recreation and Park Administration Curriculum**

Freshman Year

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Credits	Spring Semester	Credits
3	BO 103, General Botany	4
· 4	ENG 112, Composition	3
n 3	MA 122, Mathematics of Finance	
4	and Elementary Statistics _	4
	RPA 153, Aquatic Program	2
	SOC 202, Principles of Sociology	
1	MS 102, Military Science I	4
1	or	
	AS 122, Air Science I	1
16	PE 102, Physical Education	1
	Credits	CreditsSpring Semester3BO 103, General Botany4ENG 112, Composition3MA 122, Mathematics of Finance4and Elementary Statistics4RPA 153, Aquatic ProgramSOC 202, Principles of SociologySOC 202, Principles of Sociology1MS 102, Military Science I1or16PE 102, Physical Education

18

Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
BO 214, Dendrology I		ZO 206, Vertebrate Zoology	
or		or	
ZO 212, Human Anatomy		ZO 213, Human Physiology	3
EC 205. The Economic Process .		ENG 215, Prin. of News Writing	3
History Elective		PS 201, American Government Syste	m_3
RPA 201, Playground Leadership	p 3	PSY 200, Introduction to Psycholog	y 3
RPA 255, Social Recreation	4	RPA 253, Principles of Physical	•
MS 201. Military Science II	i ž	Education	3
or		MS 202, Military Science II	
AS 221. Air Science II		or	10 I.
PE 201. Physical Education	1	AS 222, Air Science II	1
		PE 202, Physical Education	1
	18		1

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Junior Year

Fall Semester	Credits	Spring Semester	Credits
ENG 231, Basic Speaking Skills		HS 342, Landscape Gardening	3
RPA 333, First Ald and Safety RPA 354, Personal and Commun	2 lity	Leadership	
Hygiene		RPA 355, Sports in Recreation	4
SOC 301, Human Behavior		**Electives within Interest Area	3
**Electives within Interest Are	a 3	Free Electives	
Free Electives	3	z	
ē			16
	17	v.	

* 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 12 semester hours of course work must be taken from the list of elective courses in the interest area.

Summer Session (9 weeks)

RPA 470, Supervised Practice _____ 6

Senior Year

Fall Semester	Credits	Spring Semester	Credits
 RPA 415, Park Maintenance and and Operation RPA 471, Organizing the Recreation Program RPA 472, Observation and Field Experience 	3 2 9	RPA 451, Facility and Site Planning RPA 452, Recreation Administration RPA 501, Special Problems in Recreation	3 3
SOC 416, Research Methods *Electives within Interest Area Free Electives	2 3 3 3 16	Free Electives	$\frac{3}{15}$

^{*} At the end of the sophomore year, a student must select an area of special interest. At least 12 semester hours of course work must be taken from the list of elective courses in the interest area. Field Work: Evidence of at least four months of satisfactory experience in the practice of his pro-

Credits



School Of Engineering

RALPH E. FADUM, Dean ROBERT G. CARSON, Director of Instruction W. E. ADAMS, Coordinator of Student Affairs

The engineer has the responsibility and the obligation to use all newly discovered knowledge in his field for the benefit of mankind. Today, a new sense of responsibility has been imposed upon the engineer, by the impact of science and technology.

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 nine engineering departments: Chemical, Civil, Electrical, Industrial, Mechanical, Mineral Industries, Nuclear, Mechanics, and Research. Undergraduate degree programs are offered in the first eight departments listed. 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 these 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 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

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.

Professional (Fifth Year) Study

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 trains 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, nuclear engineering and engineering mechanics. Aerospace 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.

Specialized Degree

A 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

The professional degree in a specialized branch of engineering 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., write to the dean of engineering at North Carolina State College, Raleigh, North Carolina.

Master of Science in a Specialized Branch of Engineering

The Master of Science in a specialized branch of engineering 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 writing the dean of the Graduate School at North Carolina State College, Raleigh, North Carolina.

Doctor of Philosophy Degree

The Doctor of Philosophy degree 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. Further information concerning the degree may be obtained from the dean of the Graduate School at North Carolina State College, Raleigh, North Carolina.

Short Courses and Institutes

The School of Engineering offers 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 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 as foremen, maintenance supervisors, etc.

Each of the engineering 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		CH 103, General and	a.,_
Chemistry	4	Qualitative Chemistry	4
ENG 111, Composition	3	ENG 112, Composition	3
E 100, Introduction to Engineering	1	EC 205, The Economic Process	
MA 101, Algebra and Trigonometry	5	or	
ME 101, Engineering Graphics I	2	HI 205, The Modern Western World	3
*MS 101, Military Science I		**MA 102, Analytic Geometry	
or		and Calculus I	4
*AS 121, Air Science I	1	ME 102, Engineering Graphics II	2
*PE 101, Physical Education	1	*MS 102, Military Science I	
		or	
	17	*AS 122, Air Science I	1
		*PE 102, Physical Education	l
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* 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.

⁺ Except the Department of Agricultural Engineering.

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

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		HI 205, The Modern Western World	
or		or	i.
ENG 205, Reading for Discovery	124	ENG 205, Reading for Discovery	
or		or	
EC 205, The Economic Process	3	EC 205, The Economic Process	3

Junior Year

Fall Semester	Credits	Spring Semester	Credits
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civil	ization 3

**Senior Year

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

Senior Electives for Humanities-Social Studies Program

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

^{*} History, economics, and literature may be scheduled in any order except that ENG 111, 112, Composition, are prerequisites for ENG 205. Only one course can be scheduled in a given semester without special permission.

^{**} The student must take either SS 491, Contemporary Issues 1, or SS 492, Contemporary Issues 11. 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.

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, Mechanical Engineer, and Metallurgical 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 the School 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 the School of Engineering.

4. Grades for each completed course are reported to the dean of the School 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 the School 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 the School of Engineering.

Department of Agricultural Engineering

Professor F. J. HASSLER, Head of the Department **TEACHING AND RESEARCH** Professors: H. D. BOWEN, J. M. FORE, W. E. SPLINTER, JAN VAN SCHILFGAARDE, JOHN W. WEAVER, JR. Associate Professor: EZRA L. HOWELL Assistant Professors: GEORGE B. BLUM, JR., W. H. JOHNSON, K. A. JORDAN, DAVID A. LINK, C. W. SUGGS Instructors: E. O. BEASLEY, J. F. BEEMAN, E. G. HUMPHRIES, EDWARD H. WISER, F. SCOTT WRIGHT Head Mechanic: RALPH B. GREENE EXTENSION Professor H. M. ELLIS, In Charge Associate Professors: J. C. FERGUSON, R. M. RITCHIE, W. C. WARRICK Assistant Professor: J. W. GLOVER Instructor: R. E. SNEED

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 laborsaving 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.

Undergraduate Curriculum

This curriculum, offered in conjunction with the School of Agriculture, 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.

Since agricultural engineering involves two distinct technical fieldsagriculture and engineering-this curriculum is a joint responsibility of the two schools and is so administered.

Facilities

The Department of Agricultural Engineering is housed in the Agricultural Engineering Building. This building, completed in 1960, embodies the most advanced facilities for education and research in the application of engineering to the production and processing of biological material for

food and fiber. Included are offices, classrooms, laboratories, shop facilities, and space for the Agricultural Engineering Extension Service.

Opportunities

Men trained in agricultural engineering 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. Graduates in this program receive the degree of Bachelor of Science in agricultural engineering.

Agricultural Engineering Curriculum

Freshman Year

Fall Semester	Credits	Spring Semester	Credits
ENG 111, Composition		ENG 112, Composition	3
MA 101, Algebra and Trigonom	etry 5	*MA 102, Analytic Geometry and	
ME 101, Engineering Graphics 1	í 2	Calculus I	4
AGE 151, Farm Mechanics	2	ME 102, Engineering Graphics II _	2
AG 103, Introduction to Agricu	lture l	AGE 152, Farm Mechanics	2
MS 101, Military Science I		CH 101, General Chemistry I	4
or		MS 102, Military Science I	
AS 121, Air Science I		or	
PE 101, Physical Education		AS 122, Air Science I	1
		PE 102, Physical Education	1
	15	·	1 1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1
			17

Sophomore Year

Fall Semester	Credits
CH 103, General Chemistry II	4
AGE 211, Farm Power and Machinery	_ 3
MA 201, Analytical Geometry and	
Calculus II	4
PY 201, General Physics I	5
MS 201, Military Science II	
or	
AS 221, Air Science II	1
PE 201, Physical Education	1

Spring Semester	Credits
EM 200, Introduction to Mechanics	3
CE 201, Surveying I	
MA 202, Analytical Geometry and	
Calculus III	4
PY 202, General Physics II	5
MS 202, Military Science II	
or	
AS 222, Air Science II	1
PE 202, Physical Education	1
-	
	17

18

Fall Semester	Credits	Spring Semester	Credits
EE 320, Elements of Electrical		BO 103, General Botany	4
Engineering	4	EC 201, Economics	
EM 301, Solid Mechanics	3	EM 303, Fluid Mechanics I	3
ENG 231, Basic Speaking Skills	3	ME 301, Engineering Thermo-	
SSC 200, Soils	4	dynamics I	3
English Elective	3	MA 301, Differential Equations	
**Elective		**Elective	3
	20		19

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

Senior Year

Fall Semester	Credits	Spring Semester	Credits
AGE 451, Conditioning Principles f	or	AGC 212, Economics of Agriculture	
Plant and Animal System	ns 2	or	
AGE 462, Farm Power and Machin		AGC 551, Agricultural Production	
ery IIA	4	Economics	
AGE 491, Rural Electrification	4	AGE 371, Soil and Water Conserva-	
AGE 552, Instrumentation for		tion Engineering	4
Agricultural Research		AGE 481, Agricultural Structures	
and Processing	1	as Production Units	4
PS 201, The American Governmenta	1	AGE 452, Senior Seminar	1
System		HI 261, The U.S. in Western	
RS 301, Sociology of Rural Life		Civilization	3
*Elective	3	Humanities Elective	
		*Elective	3
	20		
			21

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.

Department of Chemical Engineering

Professor E. M. SCHOENBORN, Head of the Department **Reynolds** Professor:

K. O. BEATTY, JR.

Professor:

JAMES K. FERRELL Associate Professors:

R. BRIGHT, J. F. SEELY Assistant Professors:

D. B. MARSLAND, E. P. STAHEL Instructors:

T. M. GODBOLD, J. C. MCGEE

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

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

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 biggest single role in the atomic energy field. The future of production of nuclear fuels, the operation and design of reactors, and the processing of irradiated materials present 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 planttype 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 employ-

ment 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 see page 130.

¥	Sobuouu	Jie leur	
Fall Semester	Credits	Spring Semester	Credits
CHE 205, Chemical Process Princip	ples _ 4	CHE 311, Introductory Chemical	4
*EC 205, The Economic Process		*ENC 905 Reading for Discovery	•••••••••••••••••••••••••••••••••••••••
or	9	-ENG 205, Reading for Discovery	2)
ENG 205, Reading for Discovery	э		Q
MA 201, Analytical Geometry and		EC 205, The Economic Process	
Calculus II		MA 202, Analytical Geometry and	
PY 201, General Physics		Calculus III	4
MS 201, Military Science II	¥)	PY 202, General Physics	5
or		MS 202, Military Science II	
AS 221. Air Science II	1	or	
PF 201 Physical Education		AS 222, Air Science II	1
11 201, 11,00000	· · · · · · · · · · · · · · · · · · ·	PE 202, Physical Education	1
	18		· · · · · ·
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C. Laurana Van

Junior Year

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

18

Elective

20

3

Credits _____ 3 _____ 3

____ 4 ____ 2 ____ 2

Senior Year

Fall Semester	Credits	Spring Semester	Credits
CH 425. Organic Chemistry		CH 426, Organic Chemistry	3
CHE 415. Chemical Engineering		CHE 432, Unit Operations Lab II _	3
Thermodynamics		CHE 525, Process Measurement	
CHE 431. Unit Operations Lab	I 3	and Control	3
CHE 460, Seminar		MIM 321, Metallurgy	3
CHE 527, Chemical Process		*SS 492, Contemporary Issues II	
Engineering		or	
*SS 491. Contemporary Issues I	1997 - A. A. Marcollon, 1997 -	Elective in Humanities	3
or		Elective	
Elective in Humanitie	es 3		-
Elective	3		18
20 · · · · · · · · · · · · · · · · · · ·	20		

* See page 131 for information concerning the Humanities Sequence.

Professional Curriculum (Typical Program)

Fall Semester	Credits
CH 401, Special Topics in	
Inorganic Chemistry CHE 570, Chemical Engineering	3
Projects	2
CHE 610, Heat Transfer I	3
CHE 660, Chemical Engineering Seminar	1
PY 407, Introduction to Modern	
Physics	
Elective	3

15

Spring Semester	Credi ts
CHE 525, Process Measurement	
and Control	
CHE 546, Chemical Reaction Rat	es 3
CHE 570, Chemical Engineering	
Projects	2
CHE 613, Distillation	
CHE 660, Chemical Engineering	
Seminar	1
Elective	
3	15

Graduate Study

Regulations governing the professional program are shown on pages 132 and 133.

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 fiuid 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.

Department of Civil Engineering

Professor C. R. BRAMER, Acting Head of the Department Professors:

C. R. McCullough, CARROLL L. MANN, JR., C. SMALLWOOD, JR., M. E. UYANIK Associate Professors:

R. H. BIGELOW*, P. D. CRIBBINS, J. W. HORN, PAUL ZIA Assistant Professors:

MICHAEL AMEIN, E. P. BRANTLY, C. P. FISHER, DONALD MCDONALD, H. E. WAHLS Instructors:

N. C. COSTES, G. N. OWEN, JR., J. B. SHULER, OKTAY URAL

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, missile launch facilities, and transportation facilities including highways, railways, waterways, airports, and

^{*} On leave.

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 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, and soil mechanics and foundations.

Civil Engineering Curriculum

For the freshman year see page 130.

Sophomore Year

Fall Semester	Credits
CE 201, Surveying I	3
MA 201, Analytical Geometry	
and Calculus II	4
PY 201, General Physics	5
*EC 205, The Economic Process	
or	
ENG 205, Reading for Discovery	3
MS 201, Military Science II	
or	
AS 221, Air Science II	1
PE 201, Physical Education	1
	17

Spring Semester	Credi ts
CE 202, Surveying II	
EM 200, Introduction to Mechanics	3
MA 202, Analytical Geometry	
and Calculus III	4
PY 202, General Physics	5
*ENG 205, Reading for Discovery	
or	
EC 205, The Economic Process	3
MS 202, Military Science II	
or	
AS 222, Air Science II	1
PE 202, Physical Education	1
	20

Junior Year

Credits
3
2
3
3
3
3
3

Spring Semester	Credi
CE 306, Transportation	
Engineering II	
CE 322, Materials Testing Lab II.	
CE 324, Structural Analysis I	
EM 302, Solid Mechanics II	
ME 301, Engineering Thermo-	
dynamics I	
SS 302, Contemporary Civilization	3
Elective	

20

Senior Year

20

Fall Semester	Credits	Spring Semester	Credits
CE 425, Structural Analysis II		CE 428, Structural Design II	I 3
CE 427, Structural Design I		CE 482, Water and Sewage	Works 3
CF 119 Soil Machania	0		

CE 442, Son Mechanics 3	CE 493, Professional Practice II 1
CE 481, Hydrology and Drainage 2	EE 320, Elements of Electrical
CE 492, Professional Practice I 1	Engineering4
*SS 491, Contemporary Issues I	*SS 492, Contemporary Issues II
or	or
Elective in Humanities 3	Elective in Humanities 3
Elective 3	Elective 3
19	17

CONSTRUCTION OPTION

Professor CARROLL L. MANN, JR., In Charge

The curriculum in civil engineering construction option is designed to suit the needs of students who are especially interested in the construction phases of civil engineering. It includes the core course requirements

^{*} See page 131 for information about the Humanities Sequence.

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 see page 130.

47	Sophor	more	Year	* :
Fall Semester	Credits		Spring Semester	Credits
CE 201. Surveying I			CE 202, Surveying II	
MA 201. Analytical Geometry			EM 200, Introduction to Mechanics	3
and Calculus II	4		MA 202, Analytical Geometry	
PY 201, General Physics	5		and Calculus III	4
*EC 205. The Economic Process		÷.,	PY 202, General Physics	5
or			*ENG 205, Reading for Discovery	2
ENG 205, Reading for Discovery	3		or	
MS 201, Military Science II			EC 205, The Economic Process	
or			MS 202, Military Science II	5
AS 221. Air Science II			or	-
PE 201, Physical Education	1		AS 222, Air Science II	1
A N			PE 202, Physical Education	1
	17		27	
				20

Junior Year

rall semester	
CE 321, Materials Testing	
Laboratory I 2	2
CE 361, Estimates and Costs I	3
EC 312, Accounting for Engineers	3
EE 320, Elements of Electrical	
Engineering é	1

Spring Semester Cre	dits
CE 322, Materials Testing	
Laboratory II	2
CE 324, Structural Analysis I	3
CE 362, Estimates and Costs II	3
EM 302, Solid Mechanics II	3
ME 301, Engineering Thermo-	
	0

EN	1 301	, sona r	viechai	nes 1		 5
SS	301,	Contemp	orary	Civili	zation	 3
		Elective				 3

dynamics I _____ SS 302, Contemporary Civilization _____ 3 Elective _____ 20

Senior Year

21

Fall Semester Cree	dits
CE 427, Structural Design I	4
CE 461, Project Planning and Control I	3
CE 485, Elements of Hydraulics and Hydrology CE 492, Professional Practice I *SS 491, Contemporary Issues I	3 1
or Elective in Humanities Elective	3 3
	7

Spring Semester Gre	aits
CE 429, Structural Design III	3
CE 443, Foundations	3
CE 462, Project Planning	
and Control II	3
CE 464, Legal Aspects of	
Contracting	3
*SS 492, Contemporary Issues II	
or	
Elective in Humanities	3
Elective	3

18

* See page 131 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 132 and 133.

с. a

Sanitary Engineering Curriculum

Professional

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

Soil Mechanics and Foundation Engineering Curriculum

Professional

Fall Semester Cre	dits
CE 525, Advanced Structural Analysis I	9
CE 548, Engineering Properties of Soils I	5 8
CE 641, Advanced Soil Mechanics	3
minants and Matrices Elective	3 3

Spring Semester	Credits
CE 524, Analysis and Design of Masonry Structures	8
CE 544, Foundation Engineering CE 549, Engineering Properties	3
of Soils II CE 642, Advanced Soil Mechanics	3 3
Elective	3

15

15
Structural Engineering Curriculum

Professional

Fall Semester	Credits
CE 525, Advanced Structural Analysis I	3
CE 625, Advanced Structural Design I	3
EM 551, Advanced Strength of Materials	3
minants and Matrices Elective	
	15

Spring Semester	Credits
CE 544, Foundation Engineering	3
CE 626, Advanced Structural	
Design II	3
CE 526, Advanced Structural	
Analysis II	
EM 602, Elastic Stability	
Elective	3
	15

Transportation Engineering Curriculum

Professional

Fall Semester	Credits	Spring Semester	Credits
CE 515, Transportation Operat CE 516, Transportation Design CE 603, Airport Planning	ions 3 3	CE 601, Transportation Planning CE 602, Advanced Transportation Design	3 1 3
and Design Electives	3 6 15	CE 604, Urban Transportation Planning Electives	3 6
			15

Graduate Study in Civil Engineering

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

Post-Baccalaureate Study in Civil Engineering Related to Other Fields

Transportation Engineering and City and Regional Planning

There exists a growing need for the coordination of transportation facilities and land planning and for individuals with competence in both fields. To fulfill this need, an advanced program leading to a post-baccalaureate degree in engineering, majoring in transportation engineering, and to the degree of Master of Regional Planning is offered through the combined resources of the Department of Civil Engineering at North Carolina State College and the Department of City and Regional Planning at the University of North Carolina. Qualified students have the opportunity to schedule their courses of instruction to enable them to qualify for both advanced degrees.

The program is designed for students who are desirous of becoming technically proficient in both the fields of transportation engineering and city and regional planning. The minimum residence requirements include two academic years plus a summer internship. The curriculum includes the major core courses for both the advanced transportation engineering program and the city and regional planning program, plus supplementary courses important to both endeavors and a thesis. A bachelor's degree in engineering, including a knowledge of transportation engineering, from an institution of recognized standing is required for admission to the program. Applicants who do not meet these requirements in full may submit their credentials for examination and consideration.

Further information concerning the joint program may be obtained from the Department of Civil Engineering at North Carolina State College or from the Department of City and Regional Planning at the University of North Carolina.

Water Supply and Waste Treatment

In recognition of the need by industry for personnel with training in water supply and the abatement of water pollution, the Civil Engineering Department suggests that students in the many curricula leading to positions in industry (food processing, textile chemistry, pulp and paper technology, chemical engineering, zoology and others) consider courses of instruction in sanitary engineering for advanced undergraduate electives, and minor sequences for advanced degrees. Among the courses appropriate for such students are the following: CE 482, Water and Sewage Works; CE 571, Theory of Water and Sewage Treatment; CE 573, Analysis of Water and Sewage; CE 673, Industrial Water Supply and Waste Disposal; and CE 674, Stream Sanitation.

Department of Electrical Engineering

Professor G. B. HOADLEY, Head of the Department Professors:

W. J. BARCLAY, A. R. ECKELS, G. E. SCHAFER, W. D. STEVENSON, JR. Associate Professors:

N. R. BELL, K. B. GLENN, A. J. GOETZE, E. G. MANNING, W. C. PETERSON, E. W. WINKLER Assistant Professor:

F. L. THURSTONE

Instructors:

D. I. FAIRBANKS, P. B. JOHNSON, F. S. KEBLAWI, T. E. MCENALLY, P. N. MARINOS, J. PENG, W. P. SEAGRAVES, T. B. SMILEY

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 at least 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, computers, 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 electrical engineering 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 the 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 manufacturing, 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 or for a school 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; and 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 see page 130.

Sophomore Year

Fall Semester	Credits	Spring Semester	Iredits
**EC 205, The Economic Process		**ENG 205, Reading for Discovery	
EE 201, Elementary Circuits		EE 202, Elementary Circuits	
and Fields		and Fields	4
MA 201, Analytic Geometry		MA 202, Analytic Geometry	2
and Calculus II	4	and Calculus III	_ 4
PY 201, General Physics	5	PY 202, General Physics	
*MS 201, Military Science II		*MS 202, Military Science II	
or		or	
*AS 221, Air Science II	I	*AS 222, Air Science II	1
*PE 201, Physical Education		*PE 202, Physical Education	1
	18		18

** See page 131 for information about the Humanities Sequence.

^{*} Students excused from military or air science and/or physical education will schedule equivalent credits outside their departments.

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 EM 200, Introduction to Mechanics MA 301, Differential Equations		EM 301, Mechanics I (Solids) **PS and AM Elective	3 3
SS 301, Contemporary Civilization	3	SS 302, Contemporary Civilization . Elective	3 3
az v ² z	17		19

Senior Year

Fall Semester	Credits	Spring Semester	Credits
EE 411, Electrical Engineering Senior Seminar	1	EE 402, Advanced Circuits and Fields EM 321, Strength of Materials I	
Fields		ME 303, Engineering Thermo-	
ME 301, Engineering Thermo- dynamics I *Senior Humanities	3 3	dynamics III *Senior Humanities Departmental Elective Elective	3 3 3
***PS and AM Elective Elective	3 3 3		18

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 132 and 133.

Graduate Study

The Department of Electrical Engineering offers the Master of Science and the Doctor of Philosophy degrees. Graduate work in electrical engineering at the first-year or master's level is limited to one or two areas of specialization. In the more advanced study for the doctorate a comprehensive understanding of all fields of electrical engineering is required, and specialization appears in the research problem undertaken.

Advanced courses of a general and fundamental nature, such as electric network synthesis and electromagnetic waves, are recommended for all graduate students in electrical engineering, and are required of 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.

* See page 131 for information about the Humanities Sequence. ** To be chosen from MA 302, 401, 405. 511 or 522 or PY 407 or ST 361, PY 552. *** To be chosen from MA 302, 401, 405, 511 or 522 or ST 361, PY 552.

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5. II

Recipients of graduate degrees in electrical engineering at North Carolina State College are in continual demand. Alumni hold important positions in the research laboratories of industry, government, and universities, in the teaching profession, and in the administrative and engineering departments of manufacturing corporations, utility companies, and government agencies.

For further information concerning graduate study in electrical engineering, the current Graduate School Catalog should be consulted.

Department of Engineering Mechanics

Professor P. H. McDonald, Head of the Department Professor: Adolphus Mitchell Associate Professors: M. H. Clayton, R. A. Douglas, John E. Griffith Visiting Associate Professor: Shou-Ling Wang Assistant Professors: J. A. Edwards, J. P. Lamb, G. W. Middleton Instructors: JAMES U. CROWDER, JR., JOE W. REECE*

In a large portion of the contemporary engineering world there is a distinct requirement for persons whose educational background encompasses concentrated study within the broad domain of engineering science, persons with the ability to analyze as well as synthesize across-the-board modernage complexes. Such a diversified background—which demands vigorous preparation in those disciplines concerned with macroscopic as well as microscopic behavior of matter—is provided in the curriculum administered by the Department of Engineering Mechanics.

Graduates of this interdisciplinary engineering sciences program will discover wide vistas of professional opportunity including teaching, fundamental engineering research, and applied research-development. In addition, those who desire to pursue their formal education to the master and doctoral level will find that the engineering mechanics program provides a very sound foundation for graduate study in engineering. Aside from its own undergraduate program the department fulfills an important service function in the engineering school as a whole by providing a core of fundamental courses-in solid and fluid mechanics-for other undergraduate engineering curricula. On the graduate level the department offers a full slate of courses covering the basic principles of generalized continuum mechanics along with the more specialized areas of solid and fluid mechanics. These courses have been designed to be useful to those who desire to concentrate in mechanics as well as those whose primary field of study requires a rigorous background in some phase of mechanics.

^{*} On leave

Curriculum

The undergraduate program in engineering mechanics provides concentration in solid and fluid mechanics, microscopic behavior of materials, thermodynamics and transport phenomena, electric-magnetic circuits and fields in addition to a foundation of classical and modern physics, mathematics, chemistry, and humanities-social studies.

In the senior year these diverse studies are brought to bear on typical contemporary engineering systems in which interactions of many physical phenomena must be considered. Senior elective sequences in space mechanics and systems analysis-synthesis are also available.

Facilities

The Engineering Mechanics Department is housed in Riddick Laboratories Building. The department's laboratories include instruments and apparatus for studying the prime variables of mechanics and the phenomena in which they occur. Special emphasis is placed on the theory of transducers and sensors such as accelerometers, hot wire anemometer, load cells, pressure probes, electric resistance gages, and the associated recording apparatus. Equipment is available to analyze the behavior of gyroscopes, the stress and strain optic tensors, yielding experiments, and the propagation of wave motion in solids; streamline patterns, pressure distributions, shock wave configurations, and boundary layer profiles.

*Engineering Mechanics Curriculum

Spring Semester

CH 101, General Inorganic Chemistry _ 4	CH 103, General and Qualitative
HI 205, The Modern Western World 3	Chemistry4
ENG 111, Composition 3	ENG 112, Composition 3
E 100, Introduction to Engineering 1	MA 201, Analytic Geometry and
MA 102, Analytic Geometry and	Calculus II4
Calculus I4	PY 201, General Physics 5
ME 102, Engineering Graphics II 2	MS 102, Military Science 1
MS 101, Military Science I	or
or	AS 122, Air Science I 1
AS 121, Air Science I 1	PE 102, Physical Education 1
PE 101, Physical Education 1	
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* This curriculum is effective beginning September, 1963. Prior to then, the curriculum will employ a transitional freshman year in common with all engineering curricula as found on page 130.

Sophomore Year

Fall Semester	Credits	Spring Semester	Gredits
EE 201, Elementary Circuits and Fields ENG 205, Reading for Discover MA 202, Analytic Geometry	y 3	EE 202, Elementary Circuits and Fields EC 205, The Economic Process MA 301 Differential Equations	4 3
and Calculus III PY 202, General Physics MS 201, Military Science II or	4 5	MIM 201, Structure and Properties of Engineering Materials EM 200, Introduction to Mechanics MS 202, Military Science II	3 3
AS 221, Air Science II PE 201, Physical Education	1 1 	or AS 222, Air Science II PE 202, Physical Education	1 1
			18

Junior Year

Spring Semester

Credi
3
3
3
3

EM 302, Solid Mechanics II
3

EM 304, Fluid Mechanics II
3

MA 511, Advanced Calculus I
3

or
or

ST 361, Statistics for Engineers
3

ME 302, Engineering Thermo3

dynamics II
3

SS 302, Contemporary Civilization
3

Elective
3

18

15

Credits

Senior Year

Fall Semester	Credits	Spring Semester	Credits
EM 401, Experimental Mechanics : Curricula Elective (Mechanics) MA 512, Advanced Calculus II	I 3 3	EM 402, Experimental Mechanics Curricula Elective (Mechanics)	II 3 3 3
or		Electives	6

ST	362,	Statisti	ics for	En	gineers	 3
ME	502,	Heat	Trans	fer		 3
	19 50	Electiv	C			 3

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Graduate Study

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The Department of Engineering Mechanics offers graduate studies leading to the degree of Master of Science.

Studies in mechanics at the graduate level normally will include initial courses in the areas of both solids and fluids to augment contemporary offerings in continuum mechanics. These courses provide a background suitable for subsequent specialization in such fields as elasticity, plasticity, or vibrations in solid mechanics; ideal viscous, or compressible fluid flow; as well as in the more generalized behavior of matter encountered in the study of rheology.

Recipients of advanced degrees in mechanics are in demand for research and development endeavors in the engineering field, in the establishments of both private industry and government. Increasing numbers of these men are choosing the opportunities afforded as members of the faculties of engineering schools and colleges.

Department of Engineering Research

N. W. CONNER, Director **Research** Professors: R. F. STOOPS, H. H. STADELMAIER **Research Associate Professors:** F. M. RICHARDSON, HAYNE PALMOUR III **Research** Associates: K. R. BROSE, S. W. DERBYSHIRE, A. E. LUCIER Visiting Research Associate: I. D. SCHOBEL **Research** Assistants: A. C. FRAKER, J. V. HAMME, G. E. SCOTT, R. B. MOFFITT, J. SINGLETARY, JR., ERNEST HARRI-SON, JR. INDUSTRIAL EXTENSION SERVICE Research Professor and Head: W. C. Bell **Research Engineers:** J. R. OGBURN, W. G. YAMAMOTO **Research** Associates: S. D. COWARD, L. B. MCGEE, J. R. HART Chemical Engineer: J. A. MACON Industrial Specialist: F. L. EARGLE **MINERALS RESEARCH LABORATORY** Chief Engineer: W. T. MCDANIEL Ore Dressing Engineers: I. REDEKER, T. J. WRIGHT Chemical Engineer: P. N. SALES

The Department of Engineering Research gives strong support and encouragement to the many research programs conducted within the School of Engineering. The establishment and maintenance of the top-rate Department of Engineering Research is a true sign that the College and the School of Engineering are fully aware of the contributions research makes to effective teaching.

The School of Engineering, a part of North Carolina's Land-Grant College, serves the industrial life of the State by offering a broad program of service and experimental aid through its Department of Engineering Research. Many State industries bring problems to the school and the association between the department and the State industries is being strengthened constantly. The department's service is further strengthened through its close cooperation with the North Carolina Department of Conservation and Development. Particular encouragement and assistance are granted investigations that give promise to new North Carolina industry.

Facilities

The Department of Engineering Research, established originally in 1923 as the Engineering Experiment Station, maintains laboratories and a fulltime staff which devotes its time exclusively to experimental work. The department's 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 Extension Service was created by the 1955 General Assembly. Its objective is to provide technical assistance to the State's small industry and to promote utilization of its natural resources.

Research Programs

The research capacity of the nation is being used for national security. Research facilities of colleges and universities are utilized for defense work. The School of Engineering at North Carolina State College is playing a leading roll in the area of national security. Several research programs sponsored by the government agencies have been in progress for several years; the school's capacity for expanded service is large.

Research 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 diffusion in alloys and electronics. Upon their conclusions, results of the engineering investigations are published as bulletins so that the information obtained is available to the public and is 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.

Department of Industrial Engineering

Professor CLIFTON A. ANDERSON, Head of the Department
Professors:
R. G. CARSON, JR., R. W. LLEWELLYN
Visiting Professor:
R. WILLARD
Assistant Professors:
*R. ALVAREZ, R. L. COPE, C. E. HUNTER
Instructors:
BIMAN DAS, *H. A. KNAPPENBERGER, A. L. PRAK, G. E. TUCKER, W. WOO

Industrial engineering is a relatively new branch of the engineering profession. It has seen its greatest growth beginning with the industrial expansion in the war years. As a college curriculum, industrial engineering 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 existing plant.

The industrial engineering program at North Carolina State College has been planned with this viewpoint in mind. After the first year, which is common with all other branches of engineering, the curriculum includes subject matter in industrial organization and management, motion and time study, plant layout, quality control, job evaluation, accounting personnel and labor relations and production control together with other specialized courses which help develop a background and technique for understanding our modern industrial system.

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

Graduation Requirements

A minimum of six weeks of continuous, gainful employment is required. This employment may be any level from laborer to supervisor. The work performed should be related to industrial activities concerned primarily with production and manufacturing, maintenance, or management control functions. The student assumes responsibility for obtaining his own employment and making arrangements with his employer to provide evidence thereof to the head the Industrial Engineering Department. A letter from the employer stating the extent and dates of employment, a description of work performed, and an evaluation of the student's performance is suitable evidence. In general the student should plan to take such employment between his junior and senior years.

* On leave

Student Activities

Student organizations within the department include a chapter of the American Institute of Industrial Engineers. This student function has demonstrated its calibre by ranking high in the Annual Student Award every year in competition with the AIIE chapters at 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 see page 130.

Sophomore Year

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

**Junior Year

Fall Semester	Credits	Spring Semester	Credits
EC 312, Accounting for Engine EM 341, Mechanics A (Statics) IE 303, Industrial Engineering MA 301, Differential Equations SS 301, Contemporary Civilizati ST 361, Statistics for Engineers Elective	ers 3 2 III 4 s I 3 on 3 s 3	EM 342, Mechanics B (Dynamics) IE 303, Industrial Engineering IV ***MA 405, Introduction to Determi- nants and Matrices SS 302, Contemporary Civilization ***ST 362, Statistics for Engineers Elective	2 4
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See page 131 for information about the Humanities Sequence.

** 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.

Senior Year

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

Professional Study

A fifth, or professional year of study is offered in industrial engineering by means of specialized and advanced course work. A student may elect a speciality 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 132 and 133.

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Production Engineering

Fall Semester	Credits	Spring Semester	Credits
IE 515, Process Engineering IE 517, Automatic Processes		IE 404, Introduction to Tool Engineering	
ST 515, Experimental Statistics for Engineers		IE 543, Standard Data IE 546, Advanced Quality Control IE 581 Project Work	3 1 3
IE 581, Project Work	2	ST 516, Experimental Statistics for Engineers	
	15		

IE	515,	Process Engineering	3
IE	517,	Automatic Processes	3
ST	515,	Experimental Statistics	
		for Engineers	4
		Elective	3
IE	581,	Project Work	2
		2 	
			15

* See page 131 for information about the Humanities Sequence.

** 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.

Industrial Engineering

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

Administrative Engineering

Fall Semester	Credits	Spring	Semester	Credits
EC 504, Principles of Cost Accountin EC 525, Management Policy and	1g _ 3	EC 505 IE 531,	, Principles of Cost Accountin Quantitative Job	1g _ 3
Decision Making	3		Evaluation Methods	3
EC 531, Management of Industrial		IE 546,	Advanced Quality Control	
Relations	3	IE 551,	Standard Costs for	
ST 515, Experimental Statistics			Manufacturing	
for Engineers	3	ST 516	, Experimental Statistics	
Elective			for Engineers	
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Graduate Study

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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

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 emphasizes the application of engineering to furniture manufacturing. Related subjects covering management, labor relations, accounting, marketing and sales stress the technical as well as the human side of modern production methods and techniques.

Graduation Requirements

A minimum of six weeks of continuous, gainful employment is required. This employment may be at any level from laborer to supervisor. The work performed should be related to industrial activities concerned primarily with production and manufacturing, maintenance, or management control functions in a furniture manufacturing plant. The student assumes responsibility for obtaining his own employment and making arrangements with his employer to provide evidence thereof to the head of the Industrial Engineering Department or the professor in charge of the Furniture Manufacturing and Management curriculum. A letter from the employer stating the extent and dates of employment, a description of work performed, and an evaluation of the student's performance is suitable evidence. In general the student should plan to take such employment between his junior and senior years.

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.

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Furniture Manufacturing and Management Curriculum

For the freshman year see page 130.

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Sophomore Year

Fall Semester Credits	Spring Semester Credits
ENG 231, Basic Speaking Skills3HI 205, The Modern Western World3PH 201, Logic3PSY 200, Introduction to Psychology3PY 211, General Physics4MS 201, Military Science II	ENG 205, Reading for Discovery3IA 203, Technical Sketching2FOR 201, Wood Properties3IE 224, Wood Working Equipment3PY 212, General Physics4MS 202, Military Science IIor
AS 211, Air Science II 1 PE 201, Physical Education 1	AS 222, Air Science II 1 PE 202, Physical Education 1 1

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 IE 322, Furniture Design and Construction IE 332, Motion and Time Study SS 301, Contemporary Civilization Electives	4 2 4 3 3	EC 312, Accounting for Engineers IE 301, Engineering Economy IE 326, Furniture Manufacturing and Processing SS 302, Contemporary Civilization TX 271, Upholstery Fabrics Electives	3 3 4 3 2 3
	16		
			18

Senior Year

a. 0 a. 00	spring semester	Credits
3 3 3 3	EC 432, Industrial Relations IE 443, Quality Control IE 452, Seminar Technical Elective Humanities Elective Elective	3 3 3 3 3 3 3 1 6
	3 3 3 3 3	EC 432, Industrial Relations EC 432, Industrial Relations IE 443, Quality Control IE 452, Seminar Technical Elective Humanities Elective Elective

Department of Mechanical Engineering

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Professor R. W. TRUITT, Head of the Department Professors:

N. W. CONNER, J. S. DOOLITTLE, K. P. HANSON, H. A. HASSAN, R. B. KNICHT, R. M. PINKERTON, J. WOODBURN Associate Professors:

W. E. Adams, M. R. El-Saden, B. H. Garcia, R. S. Lee, F. O. Smetana, J. K. Whit-

FIELD***, J. C. WILLIAMS III, J. T. YEN, C. F. ZOROWSKI Assistant Professor:

T. B. LEDBETTER

Instructors:

R. F. BARRETT, D. G. BASSETT, N. M. BEATTY, T. CEBECI, K. R. CRUMP, A. H. ERASLAN, J. MANZO, P. S. NYE, L. J. PAVAGADHI, C. S. RUDISILL, E. H. STINSON, C. O. TAYLOR, B. D. WEBB

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

*** On leave

 ^{*} 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 131 for information about the Humanities Sequence.

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. Aerospace 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 aerospace 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 transfer, gas dynamics, aeroelasticity, vibrations, lubrication, fluid mechanics, magnetohydrodynamics, aerodynamics, 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 aerospace engineering is administered as an option in mechanical engineering. Generally speaking, the curricula in mechanical and aerospace engineering differ slightly in the first three years. The point of departure occurs in the fourth year where the emphasis in the aerospace 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 aerospace 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 see page 130.

Sophomore Year

Fall Semester	Credits
*ENG 205, Reading for Discovery	
or	
EC 205, The Economic Process	3
IE 217, Machine Tools	1
MA 201, Analytical Geometry	
and Calculus II	4
PY 201, General Physics I	5
MS 201, Military Science II	
or	
AS 221, Air Science II	1
or	
PE 201, Physical Education	1
Elective	3
	10

Spring Semester Credits EM 200, Introduction to Mechanics 3 *EC 205, The Economic Process or ENG 205, Reading for Discovery _____ 3 IE 218, Metal Forming _____ 1 MA 202, Analytical Geometry and Calculus III _____ 4 PY 202, General Physics II _____ 5 MS 202, Military Science II or AS 222, Air Science II _____ 1 PE 202, Physical Education _____ 1 18

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Junior Year

Fall Semester	Credits	Spring Semester	Credits
EM 301, Solid Mechanics I MA 301, Differential Equations ME 301, Engineering Thermody		EM 303, Fluid Mechanics I ME 302, Engineering Thermo-	3
ME 305, Mechanical Engineerin Laboratory I	g 1	ME 306, Mechanical Engineering	0
ME 311, Kinematics SS 301, Contemporary Civilizati	on 3	ME 312, Dynamic Analysis SS 302, Contemporary Civilization	1 3 3
Elective		Elective	5

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	Grea
EE 331, Principles of Electrical	
Engineering	
ME 401, Power Plants	
ME 405, Mechanical Engineerin	g
Laboratory III	
ME 411, Machine Design I	3
ME 441, Technical Seminar	
MIM 421, Metallurgy I	
*SS 491, Contemporary Issues I	
or	
Elective in Humanities	5
Elective	9

spring Semester Cre	edits
EE 332, Principles of Electrical Engineering	4
ME 406, Mechanical Engineering	
Laboratory IV	1
ME 412, Machine Design II	3
ME 502, Heat Transfer	3
MIM 422, Metallurgy II	2
MIM 423, Metallurgy Laboratory	1
*SS 492, Contemporary Issues II or	
Elective in Humanities	3
Elective	3
2	20

* See page 131 for information about the Humanities Sequence.

Aerospace Engineering Option Curriculum

For the freshman year see page 130.

Sophomore Year

Fall Semester Cre	dits
*ENG 205, Reading for Discovery	
Or DO OOK The Economic Process	8
EC 205, The Economic Process	1
IE 217, Machine 1001s	1
MA 201, Analytical Geometry and	
Calculus II	4
PY 201, General Physics I	5
MS 201, Military Science II	
or	Ξ.
AS 221, Air Science II	I
PE 201, Physical Education	1
Elective	3

Spring Semester Crea	lits
EM 200, Introduction to Mechanics	3
or	
ENG 205, Reading for Discovery	3
IE 218, Metal Forming	1
MA 202, Analytical Geometry and	
Calculus III	4
PY 202, General Physics II	5
or	
AS 222, Air Science II	1
PE 202, Physical Education	1

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Junior Year

Fall Semester Credi	its Spring Seme
EM 301. Solid Mechanics 3	ME 361, Ae
MA 301, Differential Equations 3	ME 302, En
ME 301. Engineering Thermo-	dyı
dynamics I 3	ME 306, Me
ME 305. Mechanical Engineering	La
Laboratory I 1	ME 352, Ae
ME 311, Kinematics 3	SS 302, Cont
SS 301, Contemporary Civilization 3	Elec
Elective 3	

Spring Semester Cre	dits
ME 361, Aerospace Technology	3
ME 302, Engineering Thermo-	8
ME 306, Mechanical Engineering	5
Laboratory II	1
ME 352, Aerodynamics	3
SS 302, Contemporary Civilization	3
Elective	6

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Senior Year

Fall Semester	Credits	Spring Semester	Credits
EE 320, Elements of Electrical Engineering ME 441, Technical Seminar ME 465, Aerospace Engineering Laboratory ME 469, Spacecraft Structures ME 469, Spacecraft Structures ME 471, Aircraft and Missile Des MIM 421, Metallurgy I *SS 491, Contemporary Issues I or Elective in Humanities Elective	4 1 1 	ME 421, Aerospace Propulsion System ME 446, Performance of Hypervelocit Vehicles ME 466, Aerospace Engineering Laboratory ME 472, Spacecraft Design MIM 422, Metallurgy II MIM 423, Metallurgy Laboratory *SS 492, Contemporary Issues II or Elective in Humanities Elective	s 3 ty3 1 3 1 1 3 3
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* See page 131 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 programs are listed below.

Heat-Power

Fall	Sen	nester	Credits	Spring S	emester C	redits
ME ME	501, 545,	Steam and Gas Turbines Project Work in Mechanica	al .	ME 521, ME 546,	Aerothermodynamics Project Work in Mechanical	3
ME	601,	Advanced Engineering Thermodynamics I	2 3	ME 604, ME 642.	Nuclear Power Plants Mechanical Engineering	2 3
ME ME	603, 641,	Advanced Power Plants Mechanical Engineering Seminar I Approved Elective	3 1 3		Seminar II Approved Electives	1 6
			15	- 8 0	8	

Design

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3
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ME 641, Mechanical Engineering Seminar I _____1

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Aerospace

Fall Semester

Credits

15

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

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ing S	emester Cre	edits
502, 554	Heat Transfer	3
	Theory	3
546,	Project Work in Mechanical Engineering II	2
562,	Advanced Aircraft Structures	3
642,	Mechanical Engineering	
	Seminar II	1
	Approved Elective	3
	ing S 502, 554, 546, 562, 642,	 ing Semester Cre 502, Heat Transfer 554, Advanced Aerodynamic Theory 546, Project Work in Mechanical Engineering II 562, Advanced Aircraft Structures 642, Mechanical Engineering Seminar II Approved Elective

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 aerospace 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.

Department of 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:

H. C. BROWN, W. C. HACKLER, C. J. LEITH, HAYNE PALMOUR, III Visiting Research Associate:

J. D. SCHOBEL

Instructors:

G. O. HARRELL, L. E. POTEAT, J. M. WALLER

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, differential thermal analysis, thermogravimetric analysis, radiography, electron microscopy, and photomicrography.

Student Activities

The student branches of the American Ceramic Society, American Society for Metals, and the American Institute of Mining, Metallurgical and Petroleum Engineers 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 local section and national meetings of their respective societies. Keramos, the oldest professional engineering fraternity and Alpha Sigma Mu, honorary metallurgical fraternity, have active chapters in the department. These fraternities are dedicated to the promotion of scholarship, mental achievement and general service to ceramic and metallurgical engineering students.

CERAMIC ENGINEERING

The undergraduate curriculum in ceramic engineering is the result of years of study and development and is designed to meet the challenges 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 pack states of particle aggregations, rheological properties and plastic and non-plastic masses, suspensions and slurries, drying of solids, combustion, heat transfer, and high temperature chemical reactions. Production at lowest possible cost and design 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, aerospace, automotive and atomic energy fields. A continuing shortage of qualified personnel in ceramic engineering has resulted in far more employment offers than there are graduates. Initial employment upon graduation may be in the fields of research and development, in plant operation and control, and in technical sales and service. Such employment may lead to positions as directors of research, consulting and design engineers, sales directors, plant superintendents, production managers, and finally administrative officers.

GEOLOGICAL ENGINEERING

Geological engineering is a technical field in which geological facts are combined with engineering techniques for the solution of problems concerned mainly with mineral raw material supply and with engineering projects. Many major engineering undertakings, such as construction of large dams and reservoirs, tunnels, and large buildings, depend for success in part on an exact knowledge of their geological setting. On the other hand, such geological problems as the economical development of mineral resources require the use of the precise methods of engineering. In the field of geological engineering, then, geology contributes data concerning the constitution, structure and history of the earth; engineering supplies quantitative, analytical methods whereby physical and chemical laws may be controlled for mankind's benefit. The geological engineering curriculum combines those fundamental disciplines regarded as basic to all engineering with training in the aspects of geology that are of most practical application to human affairs.

Opportunities

A graduate in this curriculum may follow one of two broad fields of engineering, either in the United States or in foreign countries: one, the application of geology to engineering work: the other, the application of geology in the mineral industries. Geological engineers are currently employed 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 construction in connection with highways, foundations, excavations, and in water supply problems. The mineral industry of the Southeast has expanded substantially in the last decade; known deposits in the region, as yet only partially developed, include iron, nickel, copper, chromite, molybdenite, feldspar, mica, kaolin, kyanite, sillimanite, pyropyhllite, 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 adviser.

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, aero-space 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 see page 130.

Sophomore Year

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

Junior Year

Fall Semester	Credits	Spring Semester Cre	e di ts
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		MIC 302, Ceramic Operations II	3
MIG 330, Mineralogy	3	MIC 312, Ceramic Process	
SS 301, Contemporary Civilization	3	Principles I	4
Elective		SS 302, Contemporary Civilization	3
		Elective	3
	21		

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Summer Requirement

Six weeks' industrial employment

Senior Year

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

^{*} 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 131 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 132 and 133.

Typical Professional Program in Ceramic Engineering

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

Geological Engineering Curriculum

For the freshman year see page 130.

Sophomore Year

Fall Semester	Gredits	Spring Semester	Credits
MA 201, Analytical Geometry and		MA 202, Analytical Geometry and	
Calculus II	4	Calculus III	
PY 201, General Physics	5	PY 202, General Physics	5
MIG 220, Physical-Historical Geology	y _ 4	EM 200, Mechanics I	3
EC 205, Economic Process		ENG 205, Reading for Discovery	3
DE OOI DI LA IEL	-	DE 000 DL	1

PE 201, Physical Education. MS 201, Military Science II or AS 221, Air Science II _ 1

18

MS	202,	Military	Science	II	 . 1
PE	212,	or Physical	Educatio	n	 1
					 17

Junior Year

Fall Semester	Credi ts	Spring Semester Cred	lits
CH 431, Physical Chemistry I EM 301 Solid Mechanics I	3 3	CH 433, Physical Chemistry II 3 EE 320, Elements of Electrical	3
SS 301 Contemporary Civilizati	on 3	Engineering 4	ŧ
MIG 331, Crystallography &		SS 302, Contemporary Civilization 3	3
Opitcal Microscopy		MIG 440, Endogenic Materials and	
CE 201, Surveying I		Processes 4	4
		Flective 8	2

16

17

4 3

Summer Session

MIG 456, Geological Field Procedures

Senior Year

Fall Semester	Credits	Spring Semester	Credits
CE 382, Hydraulics		Humanities Elective	3
SS 491, Contemporary Issues		*MIG 415, Mineral Exploration and	1
MIG 351, Tectonic Structures	3	Evaluation	3
MIG 452, Exogenic Materials and		*MIG 552, Exploratory Geophysics .	3
Processes	4	Electives	6
Elective	3	14	
			15
	16		

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 Engineer. Regulations covering professional study are shown on pages 132 and 133.

Typical Professional Program in Geological Engineering

Fall	Semester	Credits	Spring Semester C	redits
MIG	461, Engineering Geology	3	MIG 522, Petroleum Geology	3
MIG	571, Mining and Mineral		MIG 552, Exploratory Geophysics	3
	Dressing		MIG 572, Mining and Mineral	
MIG	581, Geomorphology		Dressing	3
MIG	611, Advanced Economic Geolo	ogy _ 3	MIG 612, Advanced Economic Geology	_ 3
	Elective		Elective	3

15

Metallurgical Engineering Curriculum

For the freshman year see page 130.

Sophomore Year

Fall Somester

Spring Semester

Credits

15

Fall Semester	Credits	Spring Semester	Credit
**HI 205, Modern Western World		**HI 205. Modern Western World	
or		or	
ENG 205. Reading for Discovery	3	ENG 205, Reading for Discovery	3
MA 202, Analytical Geometry and		MA 202, Analytical Geometry and	
Calculus II	4	Calculus III	4
PY 201, General Physics	5	PY 202, General Physics	5
***MIM 201, Structure and Properti	es	MS 202, Military Science II	
of Engineering Material	s I3	or	
MS 201, Military Science II		AS 222, Air Science II	1
or		PE 202, Physical Education	1
AS 221, Air Science II	1	Elective	3
PE 201, Physical Education	1		
-			17
	17		

^{*} Specialization in engineering geology or in geology of mineral deposits may be achieved by an approved substitution of the following courses: CE 547 Fundamentals of Soil Mechanics; MIG 461 Engineering Geology; MIG 472 Elements of Mining Engineering.

^{**} See page 131 for information about Humanities Sequence.

^{***} 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.

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ENGINEERING 171

Junior Year

Fall Semester	Gredits	Spring Semester	Cred
CH 431, Physical Chemistry _ EM 341, Mechanics A (Statics) IE 217, Machine Tools IE 218, Metal Forming MIM 331, Physical Metallurgy SS 301, Contemporary Civiliza Minor Sequence Cou Elective	3 2 1 1 1 1 3 tion 3 irses 3	CH 432, Physical Chemistry EM 342, Mechanics B (Dynamics) EM 343, Strength of Materials MIM 332, Physical Metallurgy II SS 302, Contemporary Civilization Minor Sequence Courses Elective	
	and the second sec		10

19

echanics B (Dynamics) _____ 2 rength of Materials _____ 2 Physical Metallurgy II _____ 3 ntemporary Civilization _____ 3 finor Sequence Courses _____ 3 lective _____ 3

19

Credits

Summer Requirement

Six weeks' industrial employment

Senior Year

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

Professional Study

T-11 C

A fifth, or professional year of study is offered in metallurgical engineering as a continuation of the four-year undergraduate program. This professional year of study offers specialized advanced course work leading to the degree of Metallurgical 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 132 and 133.

^{*} See page 131 for information about Humanities Sequence.

Typical Professional Program in Metallurgical Engineering

Fall	Semester	Credi ts	Spring Semester	Credits
MIM	521, Advanced Physical		MIM 522, Advanced Physical	
	Metallurgy	3	Metallurgy	3
MIM	523, Metallurgical Factors		MIM 524, Metallurgical Factors	
	in Design	3	in Design	3
MIM	445, Experimental Engineering	3	MIM 446, Experimental Engineerin	ıg _ 3
PY 4	07, Modern Physics	3	CHE 502, Electrochemical Engineer	ing 3
ME	502, Heat Transfer	3	ME 515, Experimental Stress Analy	sis 3
	2			
R		15		15

Department of Nuclear Engineering

Professor H. A. LAMONDS, Head of the Department

The field of nuclear engineering is concerned with the engineering aspects of the control, release and utilization of nuclear energy. Many of the benefits which mankind stands to receive from the peaceful applications of nuclear power are already clear. These include improved medical diagnosis through the use of radioisotopes, superior plant development by radiation induced mutations, rapid and precise measurement techniques using radiation and perhaps best known, production of electrical power from nuclear energy. It is the aim of the department to educate individuals in the scientific and engineering principles essential to the nuclear engineering field and to prepare them to contribute to the efficient and productive use of nuclear energy through their work in the field.

Curriculum

Nuclear engineers are called upon to participate in a wide variety of highly sophisticated work, generally of an interdisciplinary nature. The curriculum is designed to provide training in the fundamentals of nuclear engineering with particular emphasis on the reactor field. The fact that an unusually high percentage of nuclear engineers continue or return to graduate study suggests that the program be aimed at a fifth year of study leading to the Master of Science degree. Minor adjustments are incorporated, however, to facilitate the student's terminating his work at four years with a Bachelor of Science degree. When one considers that nuclear engineers may be involved with every phase of the reactor field including research, development, functional design, production design, manufacturing, installation and marketing, it becomes clear that a single engineer cannot be trained to be proficient in all of these areas. On the other hand many fundamentals are common to most phases of the reactor field and certain general areas may be identified as basic. Fundamental course work is provided in four such areas: reactor theory, reactor energy transfer, electronics, and materials. In addition to this broad basic study, the students will be required to select an area of specialization providing further study in the following areas: energy transfer,

Credits

nuclear instrumentation and nuclear materials. Once a student has chosen his specialized area, he will be expected to complete a series of technical elective courses covering twelve credit hours. The three sequences offered are as follows:

Energy Transfer

Heat transfer, fluid mechanics and thermodynamics as applied to removing energy from a nuclear reactor.

 ME 503, Elements of Nuclear Power Generation I
 3

 ME 504, Elements of Nuclear Power Generation II
 3

 CHE 551, Thermal Problems in Nuclear Engineering
 3

 Free technical elective
 3

Nuclear Instrumentation

Study of the special problems and techniques used in controlling and instrumenting reactors.

							Cre	edits
EE	430,	Essentials	of Electrical	Engineering				4
EE	511,	Electrical	Engineering	0 0				
			or					
EE	515,	Elements	of Control					3
EE	518,	Instrumer	tation and Co	ontrol in Nuc	lear Tech	nology		3
		Free tec	hnical elective	e				2

Nuclear Materials

Selection and control of properties of materials used in the radiation environment.

 Credits

 MIM 331, Physical Metallurgy I
 3

 MIM 332, Physical Metallurgy II
 3

 MIM 431, Metallography I
 3

 MIM 562, Materials Problems in Nuclear Engineering
 3

At the end of the sophomore year, all students are required to select their area of emphasis. The technical elective sequence specified for each area of emphasis assures that the stated objectives will be met once the choice is made. In addition to the technical sequence, students receive a thorough foundation in basic science and mathematics, followed by courses in reactor theory and engineering.

Facilities

Facilities available on campus for nuclear training at the undergraduate level as well as the graduate level include: A 10 KW heterogeneous reactor A 100 watt homogeneous reactor Analog and digital computers A sub-critical assembly Single and multi-channel pulse height analyzers

Neutron Diffraction equipment

A slow chopper Radiation counting laboratories

Opportunities

Although the nuclear industry is relatively young, it already represents a major national effort. Reactor development and construction has proceeded at a remarkable pace and will continue to grow as we become more and more dependent on nuclear energy as a substitute for energy from fossil fuels. Industrial applications of radiation will accelerate as the economic potential of such methods becomes more firmly established. There is at present a substantial need for nuclear engineers and prospects for the future are promising.

Nuclear Engineering Curriculum

For the freshman year see page 130.

Sophomore Year

	o 11.	с. : О С т	adita
Fall Semester	Credits	Spring Semester	eaus
PY 201, General Physics	5	PY 202, General Physics	. 5
MA 201. Analytical Geometry		MA 202, Analytical Geometry	
and Calculus II	4	and Calculus III	. 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		PE 202, Physical Education	. 1
ENG 205, Reading for Discover	y 3	HI 205, The Modern Western World	. 3
MIM 201, Structures and Prope	rties	EM 200, Introduction to Mechanics	. 3
of Engineering Mate	rials 3	SS 302, Contemporary Civilization	. 3
SS 301, Contemporary Civilizat	ion 3		
1			20

20

Junior Year

Fall Semester	Credits	Spring Semester	Credi ts
PY 407. Introduction to Modern		PY 410, Nuclear Physics I	4
Physics	3	EE 332, Principles of EE	4
EM 301. Mechanics I		CHE 422, Reactor Energy Transfer 1	(I 3
MA 301, Differential Equations	3	Technical Elective	3

Elective _____

E	ngineering	g		
CHE 421,	Reactory Elective	Energy	Transfer	I

19

Senior Year

Fall Semester	Credits	Spring Semester	Credits
SS 491, Contemporary Issues		**Humanities Elective	3
NE 501, Nuclear Engineering		NE 502, Nuclear Engineering	
Systems I		Systems II	3
*MA 511, Advanced Calculus I		NE 503, Nuclear Reactor Theory I _	3
Technical Electives	6	NE 531, Elementary Nuclear Reactor	
Elective		Laboratory	1
		Technical Elective	3
	18	Elective	3

* Students with less than "B" average in mathematics should register for MA 401. ** See page 131 for information about the Humanities Sequence. 16

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School Of Forestry

RICHARD J. PRESTON, Dean

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 the United States, the forests were badly neglected and abused. Now, however, with the 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 protessional fields of forest management, pulp and paper technology, and wood technology.

Curricula

The school, through its departments of Forest Management and Wood Science and Technology, 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 mills. 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 the satisfactory 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. 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 of forestry and wood technology.

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 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 Brandon P. Hodges Laboratory building 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.

Reuben B. 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 Robertson Laboratory 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 of 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 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. 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 each year at the time they first register during a school year. A maintenance and supply fee of \$20 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 Forestry Extension Program 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 214, Dendrology	
**CH 101, General Inorganic		or	
Chemistry		*EC 201, General Economics	
or		and	

**CH 105, General Inorganic	*ME 101, Engineering Graphics	2
Chemistry4	**CH 103, General and Qualita-	
ENG 111, Composition 3	tive Chemistry	
FOR 101, Introduction to Forestry 1	or	
***MA 111, Algebra, Trigonometry 4	**CH 107, General and Oualita-	
MS 101, Military Science I	tive Chemistry	4
or	ENG 112, Composition	3
AS 121, Air Science I 1	***MA 112, Analytic Geometry	
PE 101, Physical Education	and Calculus A	4
and Hygiene 1	MS 102, Military Science I	
2 00 (2000))	or	
18	AS 122, Air Science I	1
	PE 102, Physical Education	
	and Hygiene	1

17 or 18

Forest Management and Wood Technology students take BO 214, Pulp and Paper students take ME 101 and EC 201.

^{**} Forest Management and Wood Technology students take CH 101 and 103, Pulp and Paper students take CH 105 and 107.

^{***} Students with adequate backgrounds should take MA 101, 102.

Department of Forest Management

Professor T. E. MAKI, Head of the Department Professors:

R. C. BRYANT, J. W. DUFFIELD, ARTHUR KELMAN, J. O. LAMMI, W. D. MILLER, B. J. ZOBEL Associate Professors: C. B. DAVEY, M. H. FARRIER, T. O. PERRY Assistant Professors: C. S. HODGES, L. C. SAYLOR Instructors: P. J. DYSON, R. L. MCELWEE Forest management is the application of business methods and technical

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 152 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.

Forest Management Curriculum

For the freshman year see page 181.

Sophomore Year

Fall Semester (Credits
EC 201, General Economics	3
ENG 205, Reading for Discovery	3
FOR 202, Wood Structure and	
Properties	3
MA 211, Analytic Geometry	
and Calculus	3
PY 211, General Physics	_ 4
MS 201, Military Science II	
or	
AS 221, Air Science II	1
PE 201, Physical Education	1
	18

Spring Semester	Gredits
CH 220, Organic Chemistry	4
FOR 219, Forest Economy and	
Its Operation	
PY 212, General Physics	
SSC 200, Soils	
MS 202, Military Science II	
or AC 000 AL CI II	
AS 222, Air Science II	I
PE 202, Physical Education	1

17

Summer Camp

Credits

FOR	S204,	Silviculture	8
FOR	S264,	Protection	8
FOR	S274,	Mapping and Mensuration	3
FOR	S284,	Utilization	ĩ

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Junior Year

Fall Semester	Credits	Spring Semester	Credits
FOR 361, Silvics ST 311, Statistics *ENT 301, Forest Insects **English Elective ***Option Requirement and		FOR 362, Silvics FOR 372, Mensuration *PP 318, Forest Tree Diseases **English Elective ***Option Requirement	3 3 3
Electives	9 18	and Electives	9 18

Senior Year

Fall Semester	Credits	Spring Semester	Credits
FOR 531, Forest Management ***Option Requiremen and Electives	3 nt 15 18	FOR 511, Silviculture FOR 532, Forest Management ***Option Requirement and Elective	3 3 12

Forest Management Fields of Specialization

A student selects one of the following fields of specialization and must take those courses listed under that field.

Forest Management

Credits

BO 421, Plant Physiology 4
CE 201, Surveying
FOR 404, Management Analysis 3
FOR 405, Forest Inventory 3
FOR 512, Forest Economics 3
FOR 553, Photogrammetry 2
FIR 571, Advanced Mensuration 3
ST 312, Statistics 3

²⁴

^{*} Either ENT 301 or PP 318 is required of all students. English elective is scheduled for alternate semester.

^{**} Students not making better than "C" average in ENG 111, 112, or presenting transfer credits for ENG 111, 112 will schedule ENG 321, Scientific Writing.

^{***} Electives must include at least 9 credits in humanities or social science.

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Forest Management Science

Credits

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EC 301. Production & Prices 3
EC 302, Nat'l Income & Ec. Welfare 3
EC 401, Prin. Accounting 3
FOR 512, Forest Economics 3
FOR 572, Forest Policy 3
MA 212, Calculus 3
MA 215, or 405-Finite Math or
Matrix Algebra 3
ST 312, Statistics 3

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Forest Mensuration

Credits

BO 421, Plant Physiology	4
CE 201, Surveying	3
CE 510, Advanced Surveying	3
FOR 553, Photogrammetry	2
FOR 571, Advanced Mensuration	3
MA 212, Analytics & Calculus	3
MA 215, Finite Math	3
ST 312, Statistics	3

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Watershed Management

Credits

AGE 371. Soil and Water Conser-
vation Engineering 4
CE 201, Surveying 3
FOR 553, Photogrammetry 2
MA 212, Calculus 3
MIG 120, Physical Geology 3
PY 322, Descriptive Meteorology 2

PY 333, Applied Meteorology _____ 2 SSC 511, Soil Physics _____ 4

23

Forest Biology

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Credits

BO 421, Plant Physiology	4
BO 441, Plant Ecology	3
CE 201, Surveying	3
ENT 301 or PP 318, Insects	
or Disease	3
MA 212, or MA 215	3
ZO 103, Zoology	4
ZO 551, Wildlife Science	3

23

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Forest Recreation and Parks

Credits

BO 441, Plant Ecology	3
ENT 301, Insects	
or	
PP 318, Diseases	3
MIG 120, Physical Geology	3
PSY 200, Psychology	3
RS 301, Rural Sociology	3
SOC 202, Sociology	3
ZO 103, Zoology	4
ZO 551, Wildlife Science	3

25

Forest Wildlife Management

Credits

20 103, Zoology (Soph. Year)	4
ZO 206, Vertebrate Zoology	4
ZO 301, Animal Physiology	4
ZO 520, Fishery Science	3
ZO 522, Animal Ecology	3
ZO 551, Wildlife Science	3
ZO 552, Wildlife Science :	3

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Department of Wood Science and Technology

Professor E. L. ELLWOOD, Head of the Department Professors:

R. M. CARTER, B. A. JAYNE, A. J. STAMM Associate Professors:

A. C. BAREFOOT, C. A. HART, R. G. HITCHINGS Assistant Professors:

H. D. COOK, C. G. LANDES, R. J. THOMAS Instructors:

P. J. DYSON, R. C. GILMORE, J. T. RICE

The wood industries have been a vital part of the economy of North Carolina for over 300 years. North Carolina ranks first in the nation in the manufacture of hardwood, plywood and wooden furniture, first in the South in lumber production and among the leaders in the manufacture of pulp and paper. The value of forest products produced annually in the State exceed \$1,125,000,000. Seventeen per cent of the State's labor force is employed in the wood industries.

The Department of Wood Science and Technology offers two curricula, Wood Technology and Pulp and Paper Technology, to train men for careers in the wood industries.

WOOD TECHNOLOGY

Professor E. L. ELLWOOD, In Charge

Curriculum

The great wood industries which convert wood into thousands of commercial 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

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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.

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Wood Technology Curriculum

For the freshman year see page 181.

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Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
EC 201, General Economics		CH 220, Organic Chemistry	
ENG 231, Basic Speaking Skills		FOR 203, Wood Structure and	
FOR 202, Wood Structure and		Properties II	3
and Properties I		*MA 212, Calculus	3
*MA 211, Calculus		ME 101, Engineering Graphics	
*PY 211, General Physics	4	*PY 212, General Physics	4
MS 201, Military Science		MS 202, Military Science	
or		or	
AS 221, Air Science	l	AS 222, Air Science	1
PE 201, Physical Education		PE 202, Physical Education	1
	19		18
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Summer Practicum

Credits **Credits** Second Session Wood First Session Wood Products Practicum (Five Weeks) Practicum (Five Weeks) FOR 210-S, Mensuration Practicum ____ 2 FOR 205-S, Wood Machining FOR 211-S, Logging and Milling Practicum _____ 1 FOR 206-S, Wood Drying Practicum __ 1 _ 2 Practicum FOR 212-S, Graphic Methods _____ 1 FOR 207-S, Gluing Practicum _____ 1 FOR 208-S, Wood Finishing 5 Practicum _____ 1 FOR 209-S, Plant Inspections _____ 1 5

Junior Year

Fall Semester	Credits Spring Semester		Credits
EM 341, Mechanics A (Star	ics) 2	FOR 219, Forest Economy and	

ENG 321, Scientific Writing	- 3
FOR 301, Wood Processes I	_ 4
ST 361, Statistics for Engineers	_ 3
Technical Electives	- 4

16

Its Operation	3
FOR 302, Wood Processes II	4
For 444, Intro. to Quality Control	3
Technical Electives	3
Electives	5

18

Senior Year

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

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

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
e i a Sand de C	EC 552, Econometrics	- 3
BUSINESS ADMINISTRATION	EC 310, Economics of the Firm	_ 3
× ž	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

ECONOMICSEC 301, Production and Prices3EC 302, National Income and Economic Welfare3EC 448, International Trade3EC 448, International Trade3EC 450, Economic Decision Processes3EC 552, Econometrics3EC 310, Economics of the Firm3EC 312, Elements of Accounting3EC 425, Industrial Management3

PULP AND PAPER TECHNOLOGY

Professor R. G. HITCHINGS, In Charge

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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 1960 pulp and paper products were valued at 10.7 billions of dollars and the industry employed more than 562,000 skilled workers. This is primarily a Southern industry with 60 per cent of the nation's pulpwood produced in the South.

Financially supported by 55 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 undergraduate program to serve the Southeast in this field. A number of scholarships are available. The new 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 147 credits is required for graduation. A fifth year leading to the degree of Bachelor of Science in chemical engineering is available for interested students.

Pulp and Paper Technology Curriculum

For the freshman year see page 181.

Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
CH 221, Organic Chemistry	4	CH 223, Organic Chemistry	4
*MA 211, Calculus B		FOR 342, Fiber Analysis	
*PY 211, General Physics	4	*MA 212, Calculus Ć	
MS 201, Military Science		*PY 212, General Physics	
or		MS 202, Military Science	
AS 221 Air Science	1	or	

PE	201,	Physical	Educatio	on	1
		English	Elective	*****************************	3
		Electives	·		3

AS	222,	Air	Scie	nce		 1
PE	202,	Phy	sical	Ed	ucation	 1

Summer

Credits

FOR 491, Forestry Problems, Mill Experience _____3

19

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

Junior Year

Fall Semester	Gredits	Spring Semester	Credits
CHE 301, Elements of Chemical		CHE 302, Elements of Chemical	
Engineering	3	Engineering	
CH 215, Quantitative Analysis	4	CH 231, Physical Chemistry	4
FOR 321, Pulp and Paper Technology	y 3	FOR 322, Pulp and Paper Technolog	y _ 3
ME 304, Fundamentals of Heat Pow	er _ 3	PSY 200, General Psychology	
Social Science Elective	3	Social Science Elective	3
English Elective	3	Elective	3
			-
	19		19

Senior Year

Fall Semester	Gredits	Spring Semester Credits
FOR 411, Pulp and Paper Unit Processes		FOR 403, Paper Process Analysis 3 FOR 412, Pulp and Paper
FOR 413, Paper Properties and		Unit Processes 3
Additives		FOR 461, Paper Converting 1
FOR 471, Pulping Process Analysi	s 4	FOR 463, Plant Inspections 1
FOR 491, Senior Research Problem	a 1	FOR 482, Pulp and Paper Mill
FOR 521, Wood Chemistry		Management 2
Electives		FOR 522, Wood Chemistry 3
		Electives 4

18

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School Of General Studies

FRED V. CAHILL, Dean

State College, like other Land-Grant Colleges, has from the beginning performed a two-fold function: the training of men for positions of professional and technical leadership and, at the same time, equipping them for posts of social responsibility and for life as enlightened citizens of a democratic state.

In discharging its portion of the responsibilities of the College, the School of General Studies seeks to develop the student's communication and reading skills through the study of language and literature; to increase his understanding of his economic, social, political and philosophical environment; to enhance his sense of social responsibility as a scientist and technical leader; to teach him to think critically and scientifically in the world of human affairs as he does within the confines of his professional and technological competence; and to assist him in developing physical strength and stamina as a basis for healthful living. Beyond the fundamental training required by the technical curricula, the School of General Studies also provides additional elective work in these areas. Courses of study leading to the degree of Bachelor of Science with concentrations in economics, English, history and political science, and sociology are offered by the school.

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. This board works with the school faculty in matters of policy and instruction.

Curriculum

The curriculum in the School of General Studies leading to the Bachelor of Science degree follows:

Freshman Year

Fall Semester	Credits	Spring Semester Credits
ENG 111, Composition and Rhete *Modern Language CH 101, General Chemistry I MA 101, Algebra and Trigonomet	oric 3 3 4 ry 5	ENG 112, Composition and Reading 3 Modern Language 3 CH 103, General Chemistry II 4 MA 102, Analytic Geometry and
	15	PHI 203, Introduction to Philosophy 2

* At the intermediate level.

Sophomore Year

Fall Semester	Credits	Spring Semester	Gredits
ENG 205, Reading for Discovery		ENG 205, Reading for Discovery or	
Elective	3	Elective MA 202, Analytic Geometry and	3
Calculus II	4	Calculus III	4 5
History or Social Science	5 3	History or Social Science	3
2	15		15

Junior Year

Fall Semester Cr	edits
History and Philosophy of Science	3
Course I-Humanities or Social Science	
Concentration	3
Course II-Humanities or Social Science	
Concentration	3
Course I-Advanced Technical or	
Science Option	3-4
*BO 103, General Botany	. 4
Elective	. 3
	19-20

Spring Semester Cre	dits
History and Philosophy of Science	3
Course III-Humanities or Social Science	
Concentration	3
Course IV-Humanities or Social Science	
Concentration	3
Course II—Advanced Technical or	
Science Option3	-4
ZO 103, General Zoology	4
-	6-17

Senior Year

Fall Semester	Credits
Course V-Social Sciences or Humanities Concentration	3
Science Option	3-4
Humanities or Social Science	8
Seminar	3
Elective	3

Spring Semester	Credi ts
Course VI—Social Sciences or Humanities Concentration	3
Course IV-Advanced Science or Technical Option	3-4
Elective	
Seminar	
Elective	

Department of Economics

Professor ERNST W. SWANSON, Head of the Department Professors:

E. A. FAILS, B. M. OLSEN, T. W. WOOD

Associate Professors:

A. J. BARTLEY, L. A. DOW, CLEON HARRELL

Assistant Professors:

GERALD GARB, W. R. HENDLEY, T. H. PARK, C. S. SHEN, O. G. THOMPSON

Instructors:

M. M. EL-KAMMASH, M. A. HUNT, W. J. STOBER

Adjunct Professor:

D. R. DIXON

The Department of Economics seeks to help students understand the economic process, the nature and functioning of the economy and useful

^{*} May be alternated with physics if further work in biology is anticipated.

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 engaged in extension work and economic research.

Department of English

Professor L. C. HARTLEY, Head of the Department

A. M. FOUNTAIN, H. G. KINCHELOE, R. P. MARSHALL, JACK SUBERMAN, R. G. WALSER Associate Professors:

P. H. DAVIS, H. G. ELDRIDGE, F. H. MOORE, GUY OWEN, E. H. PAGET, D. J. RULFS, A. B. R. SHELLEY L. H. SWAIN, L. R. WHICHARD, R. B. WYNNE

Assistant Professors:

LARRY CHAMPION, MAX HALPEREN, SADIE J. HARMON, A. S. KNOWLES, B. G. KOONCE, JACK PORTER, NORWOOD SMITH, PORTER WILLIAMS, JR. Instructors:

D. P. Allen, P. E. Blank, J. G. Easley, Hazel Griffin, Harry Hargrave, Eugene Hol-LAHAN, W. W. MARTIN, NANCY G. MORGAN, HOWARD PEARCE, R. B. WHITE Special Lecturer:

MARY C. WILLIAMS

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 communication 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.

Department of History and Political Science

Professor P. W. EDSALL, Head of the Department

Professors:

M. L. BROWN, F. V. CAHILL, JR., J. T. CALDWELL, A. HOLTZMAN, STUART NOBLIN, L. W. SEEGERS

Associate Professors:

L. W. BARNHARDT, B. F. BEERS, W. J. BLOCK, J. L. HELGUERA

Assistant Professors:

M. S. DOWNS, C. F. KOLB, O. H. ORR, JR. Instructors:

J. C. FARRELL, STANLEY SUVAL

An understanding of the historical background of our times and of political principles and governmental systems is expected of the educated man. The Department of History and Political Science, 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

Professors:

science are intended for undergraduates, the department offers 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 do not reside on the State College campus.

Department of Modern Languages

Professor G. W. POLAND, Head of the Department Associate Professors: F. J. ALLRED, S. T. BALLENGER

Assistant Professors:

RUTH B. HALL, H. L. TITUS Instructors:

B. S. HOWARD, S. E. 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.

Department of Philosophy and Religion

Professor W. N. HICKS, Head of the Department Associate Professors:

PAUL A. BREDENBERG, W. LAWRENCE HIGHFILL, J. LEONARD MIDDLETON

Assistant Professor:

*W. CURTIS FITZGERALD, JR.

Instructor:

WILLIAM KURYLO

The Department of Philosophy and Religion provides basic courses in philosophy and religion for students in the several professional schools of the College. The courses have been expressly planned to serve fundamental educational purposes and include offerings in the areas of logic, history of philosophy, philosophy of science, philosophy of art, philosophy of religion, ethics, the Bible and its background, religious movements in the United States, and world religions.

Effort is made to relate and make effective application of theoretical knowledge and understanding, and personal challenge is extended to the student to seek fulfillment, not in passive conformity, but in duty freely accepted and unique creativity dared.

* On leave.

Department of Physical Education

Professor P. H. DERR, Head of the Department
Professor:
W. E. SMITH
Professor Emeritus:
JOHN F. MILLER
Associate Professors:
J. B. EDWARDS, HAROLD KEATING, J. F. KENFIELD, JR.
Assistant Professors:
J. L. CLEMENTS, N. E. COOPER, ARTHUR M. HOCH, W. R. LEONHARDT, J. H. LITTLE, F. J. MURRAY, W. H. SONNER
Instructors:
H. O. FLOYD, JR., M. S. RHODES, W. M. SHEA

The purpose of the Department of Physical Education is to make 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.

Department of Social Studies

Professor G. A. GULLETTE, Head of the Department Professors: C. I. FOSTER, J. R. LAMBERT Associate Professors: R. N. ELLIOTT, R. S. METZGER Assistant Professors: W. F. EDWARDS, A. K. LOWENSTEIN Instructors: R. V. BRICKELL, R. M. CORNISH, R. J. CLACK

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.

Department of Sociology and Anthropology

Professor SANFORD WINSTON, Head of the Department Associate Professors: E. H. JOHNSON, H. D. RAWLS Assistant Professors: HERBERT COLLINS, J. G. HARDEE, J. W. TOMLIN

Courses offered by the Department of Sociology and Anthropology 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 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 urbanindustrial milieu of western civilization. He is shown that the human being operates within a social world which is the result of long cultural development, and he is encouraged to see his relationship within the framework of society with the result that he conceives of his behavior as a part of a larger social framework. The importance of adjustment to life is emphasized in all classroom teaching as well as in conferences on individual problems.





School Of Physical Sciences and Applied Mathematics

ARTHUR CLAYTON MENIUS, JR., Dean CAREY G. MUMFORD, Assistant to the Dean

Current events and the outlook for the future continue to emphasize the need for an increasing supply of high caliber scientists, mathematicians, and engineers. The School of Physical Sciences and Applied Mathematics is dedicated to helping to supply this need. In addition to the Departments of Chemistry, Experimental Statistics, Mathematics, and Physics, the operations of Physical Sciences Research, the Computing Center, and the Reactor Project were added to the school in 1961. The growth of the school since its formation in 1960 has 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.

The mission of the School of Physical Sciences and Applied Mathematics at North Carolina State College is three-fold: the training of well qualified scientists and mathematicians; the technical support of curricula in agriculture, design, education, engineering, forestry, and textiles; and research in science and mathematics.

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 radio-chemistry laboratory; a low power homogeneous reactor and a heterogeneous reactor designed for 100 kw; a one million volt Van de Graaff accelerator; two analog computers, GEDA and Donner; and an IBM 1410 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 in All Physical Sciences and Applied Mathematics Curricula

CH 101, General Inorganic Chemistry 4 CH 103, General and Qualitative or Chemistry	4
CH 105, General Inorganic Chemistry 4 or GII 105 Council and Opplitative	2
and CH 107, General and Qualitative	<u>а</u> 97
CH 106, General Inorganic Chemistry Chemistry	4
Laboratory 1 and	2
ENG 111 English Composition 3 CH 108, General and Qualitative	
MA 102 Analytic Geometry and Chemistry Laboratory	1
Calculus I 4 ENG 112, English Composition	3
PF 101 Physical Education 1 MA 201, Analytic Geometry and	
MS 101 Military Science I Calculus II	4
PE 102, Physical Education	1
AS 121, Air Science I 1 MS 102, Military Science I	75
Humanities 3 Or	
AS 122. Air Science I	1
Natural Science4 PY 205, General Physics I	4
PSM 100 Orientation 0 or	
Natural Science	4
16 or 17	
17 or 1	8

The total number of hours required for graduation is to be a minimum of 135 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.

Graduate Study

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

Department of Chemistry

Professor RALPH CLAY SWANN, Head of the Department

Professors:

THOMAS GLENN BOWERY, GEORGE OSMORE DOAK, RICHARD HENRY LOEPPERT, WALTER JOHN PETERSON, WILLIS ALTON REID, COWIN COOK ROBINSON, PAUL PORTER SUTTON, SAMUEL B. TOVE, JOSEPH ARTHUR WEYBREW

Associate Professors:

DAVID MARSHALL CATES, ALONZO FREEMAN COOTS, LEON DAVID FREEDMAN, FORREST WIL-LIAM GETZEN, LOUIS ALLMAN JONES, RICHARD COLEMAN PINKERTON, RAYMOND CYRUS WHITE Assistant Professors:

FRANK BRADLEY ARMSTRONG, THOMAS JACKS BLALOCK, LAWRENCE HOFFMAN BOWEN, WIL-LIAM PRENTISS INGRAM, JR., GEORGE GILBERT LONG, EDWARD CARROLL SISLER

Instructors:

WILLIAM RODGER JOHNSTON, ELIZABETH HINES MANNING, JOHN WESLEY MORGAN, GEORGE MOTLEY OLIVER, MRS. GRAYE JOHNSON SHAW, THOMAS MARSH WARD

The principal objective of the Department of Chemistry 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

For the freshman year see page 202.

Sophomore Year

Fall Semester	Credits	Spring Semester (Credits
CH 221, Organic Chemistry	I 4	CH 223, Organic Chemistry II	4
CH 222, Organic Chemistry	Lab 1	CH 224, Organic Chemistry Lab	1
MA 202, Analytic Geometry		MA 301, Differential Equations	3
and Calculus III	4	PY 207, General Physics	_ 4
PY 206, General Physics		English	3
English		MS 202, Military Science II	
MS 201, Military Science II		or	2
or		AS 222, Air Science II	1
AS 221, Air Science II	1	PE 202, Physical Education	1
PE 201, Physical Education	1		
•			17
	18		

Junior Year

Fall Semester	Credits	Spring Semester C	Credits
CH 431, Physical Chemistry I		CH 433, Physical Chemistry II	3
CH 432, Physical Chemistry Lab.	1	CH 434, Physical Chemistry Lab.	1
ML 103, Elementary German	3	CH 411, Analytical Chemistry I	_ 4
Minor		ML 104, German Grammar and	
Humanities		Prose Reading	3
Free Electives		Minor	3
		Humanities	3
	16		-
			17

Free	Electives		3
		1	6

Senior Year

Fall Semester	Credits	Spring Semester	Credits
CH 413, Analytical Chemistry	II 4	CH 501, Inorganic Chemistry I	
Major		Minor	3
Minor		Humanities	3
Humanities		Free Electives	7
Free Electives			······
			16
	16		

Chemistry majors are required to take CH 105, CH 106, CH 107, and CH 108. The Chemistry Department will recognize as a minor four semester courses in the biological sciences, engineering, mathe-matics, 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 application of chemistry in the areas chosen. This sequence is to be chosen in consultation with the faculty adviser prior to the third year of study.

Department of Experimental Statistics

Professor J. A. RIGNEY, Head of the Department

Professors:

R. L. ANDERSON, Graduate Administrator, C. C. COCKERHAM, A. H. E. GRANDAGE, R. J. HADER, H. L. LUCAS, F. E. MCVAY, D. D. MASON, R. J. MONROE, D. R. SHREVE, R. W. STACY, R. G. D. STEEL

Visiting Professor:

D. W. HAYNE

Adjunct Professors:

W. S. CONNOR, A. L. FINKNER

Professor Emeritus:

GERTRUDE M. COX

Associate Professors:

W. J. HALL, R. G. PETERSON, C. H. PROCTOR, W. W. G. SMART, T. D. WALLACE Visiting Associate Professors:

J. C. KOOP, H. R. VAN DER VAART Adjunct Associate Professor:

S. Addelman

Assistant Professors:

J. O. RAWLINGS, F. J. VERLINDEN Assistant Statisticians:

M. A. CIPOLLONI, J. H. MEADE, W. S. OVERTON, C. A. ROHDE, B. J. STINES, E. H. YEN

Statistics is a relatively new and rapidly expanding science. It is 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 statistics 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 based on scientific sampling 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

For the freshman year see page 202.

Assuming BO 103 and PY 205 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 202, Calculus II	4	MA 301, Differential Equations	3
PY 206, General Physics II	4	PY 207, General Physics III	4
EC 201, Economics		EC 202, Economics	
Foreign Language		ZO 103, General Zoology	4
MS 201, Military Science	l	Foreign Language	3
PE 201, Physical Education		MS 202, Military Science	1
		PE 202, Physical Education	1
4477	16		
		8 2 8' :	19
	Junio	r Year	

Fall Semester	Creilits	Spring Semester C	redits
ST 361, Introduction to Statistics PSY 200, Introduction to Psychology ENG 321, Scientific Writing Minor Humanities	3 3 3 3	ST 362, Introduction to Statistics ST 302, IBM Laboratory Minor Humanities Free Electives	3 2 3 3 6
	15		17

Senior Year

Fall Semester	Credits	Spring Semester	Credits
ST 421, Basic Statistical Theory	3	ST 422, Basic Statistical Theory _ ST 516 Experimental Statistics	

for Engineers	3
Minor	3
Humanities	3
Free Electives	3
Major Electives	3

for Engineers _		
Minor	Ф Щ	
Humanities	*****	
Free Electives _		- '

16

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Graduate Study

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.

Department of Mathematics

Professor JOHN W. CELL, Head of the Department Professors:

R. C. BULLOCK, J. M. CLARKSON, W. J. HARRINGTON, M. ITOH, JACK LEVINE, C. G. MUMFORD, H. M. NAHIKIAN, Graduate Administrator, H. V. PARK, Administrative Assistant, D. R. SHREVE, R. A. STRUBLE, J. H. WAHAB, H. P. WILLIAMS, L. S. WINTON

Associate Professors:

H. C. COOKE, A. R. NOLSTAD, D. M. PETERSON, H. A. PETREA, H. E. SPEECE, H. VAN DER VAART, G. C. WATSON

Adjunct Associate Professor:

ROBERT T. HERBST

Assistant Professors:

V. R. BRANTLEY, E. J. CANADAY, D. L. GEORGE, D. J. HANSEN, C. F. LEWIS, C. H. LITTLE, JR., MORTON LOWENGRUB, R. A. MACKERRACHER, ARMSTRONG MALTBIE, L. B. MARTIN, JR., PETER SHAHDAN, J. B. WILSON

Instructors:

C. N. ANDERSON, DOROTHY L. BRANT, JOYCE CARAWAY, MARTHA J. GARREN, RUTH B. HON-EYCUTT, JULIE G. MCVAY, D. E. NIXON, CARLOTTA P. PATTON, J. L. SOX, G. S. SPEIDEL, JR.

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 degree 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 in which mathematics is applied. 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 with a strong foundation for future graduate work.

Mathematics Curriculum

For the freshman year see page 202.

Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
MA 202, Calculus and Analytic Geometry III PY 206, General Physics II	4 4	MA 301, Differential Equations PY 207, General Physics III **Humanity Elective	3 4 3
English Literature *Modern Language MS 201, Military Science II	3 3	*Modern Language MS 202, Military Science II or	3
or AS 221, Air Science II PE 201, Physical Education Humanity Elective	1 1 3	AS 222, Air Science II PE 202, Physical Education Free Elective	1 1 3
	19		18

Junior Year

Fall Semester	Cred	its Spring S	lemester	Credits
MA 403, Fund MA 441, Advan Statis ****) **Hu Free	amental of Algebra 3 nced Calculus I 3 tics 3 Minor 3 manity Elective 3 Elective 3	MA 405, MA 512,	Introduction to Determinants and Matrices Advanced Calculus II Statistics ****Minor Humanity Elective Free Elective	i- 3 3 3

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Senior Year

Fall Semester	Credits	Spring Semester	Credito
Major *Minor **Humanity Elective Erea Elective	6 3 3 3	***Major ****Minor **Humanity Elective Free Elective	6 6 3
ŭ.	5		2 14

Graduate Study

The faculty of 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 two semesters of advanced calculus and two of modern algebra (or the equivalent). In addition, he should have a strong background in mechanics, physics, or in some other mathematically oriented area.

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,

*** To be chosen from mathematics offerings at the 400-500 level.

^{*} The particular language chosen (French, German, or Russian) 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, or from modern language offerings beyond the required courses.

^{****} 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 or during the junior year and this choice is subject to the approval of the department head.

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 and for requirements for the Doctor of Philosophy degree see the Graduate School Catalog.

Department of Physics

*Burlington Professor RAYMOND L. MURRAY, Head of the Department Burlington Professor:

WILLARD H. BENNETT

Professors:

W. O. DOGGETT, HARRY C. KELLY, FORREST W. LANCASTER, J. S. MEARES, A. C. MENIUS, JR., R. H. SNYDER, NEWTON UNDERWOOD, A. W. WALTNER

Associate Professors:

** J. T. LYNN, Graduate Administrator, R. F. STAINBACK, E. JACK STORY Assistant Professors:

E. J. BROWN, WILLIAM P. BUCHER, GROVER C. COBB, JR., R. L. DOUGH, WILLIAM R. DAVIS, RAOUL M. FREYRE, D. H. MARTIN, M. R. MOSS, J. Y. PARK

Instructors:

HUBERT L. OWEN, J. T. SPENCE

Physics is a fundamental science of observations, measurements and mathematical description of the particles and processes of nature. Included is the study of classical physics-mechanics, heat, sound, electricity, magnetism and optics-plus modern physics embracing atomic, ionic, and nuclear particles and phenomena. In addition to extending our basic knowledge of the universe, the science of physics provides an attack on problems of importance in modern technology. The variety of the contributions made by physicists is indicated by these typical activities-discovery and measurements on new particles of nature; the invention and use of new instruments to probe interplanetary space; the prediction of behavior of nuclear chain reactors; the study of processes fundamental to the release of thermonuclear energy; and research on missiles, satellites and space craft.

Programs

The Physics Department provides courses in fundamental physics and in several specializations relating to nuclear reactions, reactor analysis, radioactivity, radiological health and safety, electrical discharges in gases, and space phenomena.

Opportunities

The demand for graduates with fundamental and specialized knowledge in physics has grown rapidly in recent years. The demands for scientists are currently greatest in the nuclear energy and missile and space 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.

^{*} On leave ** Acting head

Physics Curriculum

Typical curricula emphasizing fundamental physics and nuclear science are shown below.

For the freshman year see page 202.

Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
PY 206, General Physics		PY 207, General Physics	
MA 202, Analytic Geometry and		MA 301, Differential Equations	
Calculus III	4	English Elective	
Foreign Language		Foreign Language	
Humanities Elective		Humanities Elective	
PE 201, Physical Education	1	PE 202, Physical Education	1
MS 201, Military Science II		MS 201, Military Science II	
or		or	
AS 201, Air Science II	1	AS 201, Air Science II	1
	16		18

Junior Year

Fall Semester	Credits	Spring Semester	Credits
PY 401, Mechanics or PY 403, Electricity and Magnetism PY 407, Modern Physics MA 441, Advanced Calculus I SS 301, Contemporary Civilization Minor Free Elective	4 3 3 3 3 3	PY 402, Heat and Sound or PY 404, Optics PY 410, Nuclear Physics I Mathematics SS 302, Contemporary Civilization _ Minor	4 4 3 3

19

Senior Year

(Fundamental Physics Emphasis)

Fall Semester	Credits	Spring Semester	Credits
PY 401, Mechanics or PY 403, Electricity and Magne Mathematics SS 491, Contemporary Issues Minor Free Electives	etism 4 3 3 6	PY 402, Heat and Sound or PY 404, Optics Mathematics PHI 405, Foundations of Science Minor Free Elective	4 3 3 3
			Constant and

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Senior Year

(Nuclear Science Emphasis)

Fall Semester	Credits	Spring Semester	Credi ts
PY 510, Nuclear Physics II4 PY 518, Radiation Hazards and Protection3 Mathematics3 SS 491, Contemporary Issues3 Free Electives	 PY 520, Physical Measurements in Radioactivity PY 530, Introduction to Nuclear Reactor Theory PY 531, Nuclear Reactor Laboratory Mathematics 	3 3 1 3	
	19	PHI 405, Foundations of Science Free Elective	3 3 16
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Graduate Study

The Department of Physics provides programs of advanced study in applied physics leading to the master's and doctor's degrees. A research thesis is required for each degree. A comprehensive understanding of classical and modern physics is stressed, with study in either nuclear science or fundamental physics, nuclear reactor theory, radiological health and safety, plasma physics, space physics, and the theory of fields. Work in the student's minor field will generally be taken in other departments of the School of Physical Sciences and Applied Mathematics. Research facilities available include a 10-kilowatt heterogeneous reactor, a 100-watt water boiler reactor, a natural uranium sub-critical assembly, a one-Mev Van de Graaff accelerator, and high speed computing equipment. Plasma laboratories with precision equipment are available. Experimental research is in progress on neutron diffusion by pulsed methods, high current particle streams, and simulation of space conditions. Research and teaching assistanships are available to qualified graduate students.

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Computing Center

Professor D. R. SHREVE, Director

An IBM 1410 digital computer is located in the Computing Center in Patterson Hall. The computer, a card-type system with 40,000 characters of core storage, is used for faculty and student research, and for instruction in scheduled credit courses and non-credit short courses.

Credit courses in computing are supplemented by instruction in computer programming included in courses offered by several departments in the College, by a continuous offering of non-credit short courses, and by use of IBM 1620 computers, and a variety of analog computers in several other departments.

Physical Sciences Research

E. J. STORY, Head Research Engineer: M. A. KOONTZ Research Associate: B. E. LEONARD

The Burlington Nuclear Laboratories building, which houses a 100 kilowatt heterogeneous research reactor, plus 32 rooms including research laboratories, offices and shops, is the school's major facility for research in nuclear physics, radiation, and nuclear sciences. The facilities also include a 100 watt homogeneous reactor, a natural uranium subcritical assembly, and a considerable investment in research equipment, principally nuclear electronics.

Other major facilities in the School of Physical Sciences and Applied Mathematics include plasma physics laboratories, a 1 Mev Van de Graaff accelerator, chemistry and radioisotope laboratories, a spectroscopy laboratory and analog computers.

In addition to contracted research for industrial firms, support is received from federal agencies.



School Of Textiles

MALCOLM E. CAMPBELL, Dean JAMES W. KLIBBE, Academic Coordinator

The manufacture of textiles has become one of the world's leading industries. North Carolina's textile industry 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 suppliers 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 spinner, weaver, 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.

In the educational program, for administration, the School of Textiles is organized into three departments: Textile Technology, Knitting Technology, and Textile Chemistry.

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 Nelson 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. The Department of Textile Chemistry is housed in remodeled Mangum Hall, one hundred yards south of the Nelson Textile Building.

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 selected by State College textile graduates are production of yarns, production of woven and knitted fabrics, dyeing and finishing, industrial engineering, quality control, designing, styling, merchandising, converting, research, cost and production control, and 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 desirable 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 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.

Distinguished Professorships

The School of Textiles has four sponsored professorships. These are made possible by funds contributed to the North Carolina Textile Foundation, Inc., and especially designated to pay a part of the annual salary of the professor selected to fill the position.

The four professorships, together with the year of establishment and the name of the incumbent for each, are as follows:

Burlington Industries Professorship of Textiles 1946, Dame S. Hamby, 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 Professor of Yarn Manufacturing 1948, Elliot Brown Grover, professor of textiles and head of Department of Textile Technology.
Edgar and Emily Hesslein Professorship of Fabric Development 1948. (open)

Department of Knitting Technology

Professor WILLIAM E. SHINN, Head of the Department and Director, Knitting Research Assistant Professor: H. M. MIDDLETON, JR. Instructor: PETER LI

In recognition of the great importance of knitting and the other needle arts in the industrial life of this section, the Department of Knitting Technology makes available to this branch of the textile industry, personnel trained in the fundamentals and practices underlying the production of knitted textiles.

Curriculum

Knitting technology students follow the textile technology curriculum and elect Stem 4. For a list of the curriculum by years see pages 223 and 224.

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 solid color patterns.

Nylon Hosiery

This section is equipped with 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 class are employed for instruction in the producton 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.

Department of 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

The purpose of the Department of Textile Chemistry 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

Two recent changes in the curriculum in textile chemistry have resulted in a strengthening of the program. In the senior year, the student is given the option of electing a course of study which includes physical

chemistry or may in its place elect a stem of courses in textile technology. In the latter, three areas are provided which furnish depth in quality control, fabric technology, or yarn technology. A student may elect also a three-course sequence of a minimum of nine semester hours in psychology, industrial engineering, or from the School of General Studies.

Students who expect to pursue a course of graduate study are urged to take the chemistry option. The technology option is primarily for students who expect to go into production.

In either option, the curriculum places emphasis on the fundamentals of chemistry. Adequate background in social sciences and humanities is also provided.

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. 2 4 . 6

Five courses, that are described in the section on Description of Courses, (TC 403, 404; TC 511, 512; TC 605; and TC 606), are the core of the education 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 follow:

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

Six 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 equiment used for evaluation and for determining color-fastness, wash-fastness, etc., of dyed fibers and fabrics.

Textile Chemistry Curriculum

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Freshman Year

Fall Semester	Credits	Spring Semester	Credits
ENG 111, English CH 105, Chemistry MA 101, Mathematics HI 252, U. S. History *MS 101, Military Science I or *AS 121, Air Science I *PE 101, Physical Education	3 5 3 1 1 1 1 1	ENG 112, English CH 107, Chemistry MA 102, Mathematics TX 221, Fundamentals of Textiles ME 101, Engineering Graphics *MS 102, Military Science I or *AS 122, Air Science I *PE 102, Physical Education	$ \begin{array}{c} 3 \\ 4 \\ 4 \\ 3 \\ 2 \\ 1 \\ 1 1 $
17. E	17 S		Contract Distances in the

Sophomore Year

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Fall Semester	Gredits	Spring Semester	Credits
MA 211, Calculus PY 211, Physics CH 221, Organic Chemistry TX 281, Fiber Quality *MS 201, Military Science II	3 4 3	MA 212, Calculus PY 212, Physics **English Elective CH 223, Organic Chemistry TX 261 Fabric Structure	3 3 4
or *AS 221, Air Science II *PE 201, Physical Education	1 1 16	*MS 202, Military Science II or *AS 222, Air Science II *PE 202, Physical Education	3 1 1 1

 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 languages.

Junior Year

Fall Semester	Credits	Spring Semester	Credits
 *English Elective		PS 201, American Government Humanities or Economics TX 327, Textile Testing CH 215, Quantitative Analysis TC 304, Textile Chemistry III Electives	3 4 4 3 3
18 ÷	18	÷	20

Senior Year

Fall Semester	Credits	Spring Semester	Credits
TC 403, Textile Chemical Tech TC 405, Textile Chemical Tech TC 511 Chemistry of Fibers	nology _ 3 n. Lab 2 3	TC 404, Textile Chemical Tech TC 406, Textile Chemical Tech TC 501, Seminar in Textile	nology 3 n. Lab 2
TC 412, Textile Chemical Anal	ysis 3	Chemistry TX 581, Instrumentation	2 3
CH 431, Physical Chemistry (1) or) 3	Electives CH 433, Physical Chemistry (1	3 1) 3
Stem Hours (See below) (2) -	3 	or Stem Hours (See below) (2) -	4
	17		16 or 17

(1) Only for students electing chemistry option.

(2) Only for students electing technology option.

Credits Required—Freshman year, 35; sophomore year 35; junior year 38; senior year, Physical Chemistry Option 33; total 141. Senior year Technology Stem Option, 34; total 142.

Stem Requirements

Stem 1. Quality Control	Credits	Stem 2. Fabric Technology C	redits
TX 521, Textile Testing II		TX 365, Fabric Technology	4
TX 522, Textile Quality Control	3 1	Characteristics	_ 3

7

7

Stem 3. Yarn TechnologyCreditsTX 303, Fiber and Yarn Technology4TX 430, Continuous Filament Yarns4Or7

Stem 4. General

Students electing this stem must take a three-course sequence totaling a minimum of nine semester hours. The sequence will generally be selected from courses in psychology, industrial engineering, or from the School of General Studies. The sequence must be approved by the student's adviser.

^{*} If approved in advance, students who average C or above on composition, English 111, 112 may substitute 6 credits of modern language.

^{**} Students electing Stem 4 may use these credits in conjunction with the stem hours to take a threecourse sequence in psychology, industrial engineering, or economics.

Department of Textile Technology

Professor ELLIOT B. GROVER, Head of the Department and Textile Research Professors:

J. F. BOGDAN, Director, Processing Research, D. S. HAMBY, J. A. PORTER Associate Professors:

W. E. MOSER, J. E. PARDUE, W. C. STUCKEY, JR. Assistant Professors:

E. B. BERRY, J. W. KLIBBE, W. E. SMITH, R. E. WIGGINS Instructors:

I. A. BIRKAN, JAMES A. KING, L. T. LASSITER. W. K. LYNCH, H. I. MAKHLOUF

The purpose of the Department of Textile Technology 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. In addition, the department is engaged in research, with the support for the basic areas of work coming from college funds, and applied research through the sponsors of the work. Not only faculty, but graduate and, when practical, undergraduate students are encouraged to participate in the research programs.

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 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.

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Facilities

The facilities of the Department of Textile Technology 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 laboratory is 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, doubler 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 dressing 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 type 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 darkroom 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.

Textile Technology Curriculum

(Fiber and Yarn Technology, Fabric Technology, General Textiles, and Knitting Technology Stems)

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	-		-	-	-	-		•	-	-		-		-	-	-	

Fall: Semester	Credits	Spring Semester	Credits
CH 101, Chemistry	4	CH 103, Chemistry	4
*MA 101, Mathematics	5	*MA 102, Mathematics	
ENG 111, English		ME 101, Engineering Graphics	
HL 252, U. S. History		ENG 112, English	
**MS 101, Military Science I		TX 221, Fundamentals of Textile	s 3
or		**MS 102, Military Science I	
**AS 121, Air Science I	1	or	
**PE 101, Physical Education		**AS 122, Air Science I	
ALC N 1 2 3		**PE 102, Physical Education	
	17		
			18

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, and Sociology.

Sophomore Year

Fall Semester	Credits
PY 201, Physics	5
and	
MA 201, Calculus	4
or	
PY 211, Physics	4
and	2
*Electives from Schedule A	3
**English	
PS 201, American Government	
TX 261, Fabric Structure	3
***MS 201, Military Science II	
or	
***AS 221, Air Science II	1
***PE 201, Physical Education	1

Spring Semester	Credits
PY 202, Physics	5
and	
MA 202, Calculus	4
or	
PY 212, Physics	4
and	
*Electives from Schedule A	4
Humanities or Economics	
TX 281, Fiber Quality	
***MS 202, Military Science II	
or	
***AS 222, Air Science II	1
***PE 202, Physical Education	1
	10 10

18 or 20

16 or 17

Junior Year

Fall Semester	Credits	Spring Semester	Credits
English ST 361, Statistics TX 303, Fiber and Yarn Tech. TC 201, Textile Chemistry I TX 365, Fabric Technology TX 342, Knitting Principles	3 3 4 2 4 2	TX 327, Textile Testing Free Electives Stem Hours ***Elective from Schedule A .	4 3 8 3 15 or 18

18

Senior Year

Fall Semester	Credits	Spring Semester	Credits	
Humanities	3	Social Sciences		
TV 581 Instrumentation	2	TX 485 Mill Design and		

IN	501,	mouum	cintation		J
тс	307,	Textile	Chemist	r y	4
ΤХ	442,	Knitted	Fabrics		
Free	Ele	ctives			3
Sten	n Ho	ours	*******		3
				3 • .	-

	Orga	nization	 3
Free	Electives		 6
Stem	Hours		 5
			 17

19

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

^{*} Students selecting this sequence of courses must re-schedule hours in second semester of sophomore and junior year.

^{**} If approved in advance, students who average C or above on Composition, English 111, 112, may substitute 6 credits of modern languages.

^{***} 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.

^{****} Students electing PY 201, 202; MA 201, 202 sequence do not take this course.

Stem Requirements

(Fiber and Yarn Technology, Fabric Technology, General Textiles, and Knitting Technology Stems)

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

Stem 1. Fiber and Yarn Technology Credits	Stem 2. Fabric Technology Credits
TX 304, Fiber & Yarn Tech 4	TX 366, Fabric Technology 4
TX 436, Staple Fiber Process 3	TX 575, Fabric Analytics and
TX 430, Cont. Filament Yarns 3	Characteristics 3
and either	TX 478, Design and Weaving 3
TX 366, Fabric Technology 4	and either
and	TX 304, Fiber and Yarn Tech 4
TX 483, Textile Cost Methods 2	and
or	TX 483, Textile Cost Methods 2
Selection from Schedule B 6, 7, or 8*	or
	Selection from Schedule B 6, 7, or 8*
16 (to 18)	
	16 (to 18)

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

Stem 3.	General	Textiles	Credits	Stem 4.	**	*Knittinį	g Tec	hnology	Cr	edits
TX 304, TX 366, TX 483, Electives	Fiber & Fabric 7 Textile from Sc	Yarn Tech. Fechnology Cost Metho chedule C	4 4 ds 2 6	TX 483 TX 430 TX 441 TX 444	8, T 0, C 1, F	Cextile C Continuo Clat Knii	Cost us Fi tting Man	Methods lament Y	arns	2 3 3
			16	TX 447 Transfe	7, 7 L er t	448, Adv ab o Free]	vance Electi	d Knitti	ng 	3 4 1

16

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:

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

Credits TX 436, Staple Fiber Processing ______ 3 and TX 430, Continuous Filament Yarns ____ 3 TX 575, 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

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 Technology Curriculum (Management Option)

Freshman Year

Fall Semester	Credits	Spring Semester	Credits
CH 101, Chemistry *MA 101, Mathematics ENG 111, English HI 252, U. S. History **MS 101, Military Science I or	4 5 3 3	CH 103, Chemistry *MA 102, Mathematics ME 101, Engineering Graphics ENG 112, English TX 221, Fundamentals of Textiles **MS 102, Military Science I	4 2 3 3
**AS 121, Air Science I **PE 101, Physical Education	1 1 17	or **AS 122, Air Science I **PE 102, Physical Education	1 1 18

Sophomore Year

Fall Semester	Credits	Spring Semester	Credits
PY 211, Physics MA 201, Mathematics or	4 4	PY 212, Physics MA 202, Mathematics or	4 4
***MA 211, Mathematics PS 201, American Government TX 261, Fabric Structure EC 201, Economics	3 3 3 3	***MA 212, Mathematics TX 281, Fiber Quality EC 301, Economics **MS 202, Military Science II	3 3
 **MS 201, Military Science II or **AS 221, Air Science II **PE 201, Physical Education 	1 1 18 or 19	or **AS 222, Air Science II **PE 202, Physical Education	1 1 15 or 16

* 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.

** 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. *** Students selecting this option transfer 2 hours to free electives.

Junior Year

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

Senior Year

Fall Semester	Credits	Spring Semester	Credi ts
*English TC 307, Textile Chemistry II TX 342, Knitting Principles Free Electives Stem Hours	3 4 2 3 6	TX 485, Mill Design and Organization EC 490, Senior Seminar in Economic Free Electives Stem Hours	3 s 3 6 6
5.c.m 210015	18	Stem results	0

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

Additional Stem Requirements

Stem 5. Micro-Economics	Credits	Stem 6. Macro-Economics	Credits
EC 312, Accounting for Engineers		EC 312, Accounting for Engineers	
or		EC 444, Economic Systems	3
EC 413, Competition, Monopoly		EC 448, International Economics	3
and Public Policy		Selections from Schedule D	9
Two courses from the following in	n		
economics: EC 310, EC 410, or EC	C		21
413, EC 440, EC 446, and EC 448 _	6		
Selection from Schedule D			

 Stem 7. Applied Economics
 Credits

 EC 312, Accounting for Engineers
 3

 EC 410, Industry Studies
 3

 or
 0

 EC 450, Economic Decision Processes
 3

 EC 552, Econometrics
 3

 **MA 405, Introduction to Determinants & Matrices
 3

 Selections from Schedule D
 9

 21

* If approved in advance, students who average C or above on Composition, English 111, 112, may substitute 6 credits of modern language.

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

Textile Research

The School of Textiles 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 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.

Textile Machine Development

C. M. ASBILL, JR., Head

The Department of Textile Machine Development was established to assist the textile industry and the students of the School of Textiles in matters relating to textile processing machinery and testing apparatus.

Specifically the objective of the department is to make available to the textile industry and to the faculty and students of the School of Textiles the facilities of a qualified textile engineering department with means for the design, construction and testing of new or improved equipment.

The department attempts to keep informed as to modern machinery and practices by maintaining close contact with textile mills and machine manufacturers as well as by a digest of technical articles and patents, and by participation in technical and scientific conferences. The physical facilities of the department include a completely equipped machine shop and electronics section, together with thoroughly trained operating personnel.

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.

Textile Library

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 incorporating the entire textile collection from the D. H. Hill Library. There are now about 9,000 volumes of which 3,000 are bound periodicals. The library subscribes to 150 current periodicals, both American and foreign, which are thoroughly indexed in Industrial Arts Index, Chemical Abstracts, Natural and Synthetic Fibers, Textile Technology Digest, and Textile Institute Journal Abstracts.

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.



THE GRADUATE SCHOOL

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.

Master's Degrees

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At State College graduate instruction is offered in the following fields: agriculture, education, engineering, forestry, physical sciences and applied mathematics, and textiles. The Master of Science degree 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.

Doctor of Philosophy Degree

The Doctor of Philosophy degree is offered in the following fields: agricultural economics, agricultural engineering, animal science, applied mathematics, applied physics, bacteriology, botany (in the fields of physiology and ecology), ceramic engineering, chemical engineering, civil engineering, crop science, electrical engineering, entomology, experimental statistics, food science, forestry, genetics, mechanical engineering, nuclear engineering, plant pathology, rural sociology, soil science, and zoology (in the fields of ecology and wildlife biology).

Students interested in graduate study should consult the Graduate School Catalog which is sent to them upon request. Inquiries should be addressed to: Dean of the Graduate School, North Carolina State College, Raleigh, North Carolina.



COLLEGE EXTENSION DIVISION

EDWARD W. RUGGLES, Director

The College Extension Division's services, which cover a multitude of fields, are designed for persons who cannot attend classes on the campus and for designated groups and communities.

There must be a sufficient number of persons registered for a course for it to be held. In setting up courses, such matters as distance from the College, nature of the subject, and availability of instructors must be taken into consideration.

Correspondence Courses

Correspondence courses for college credit are offered in agriculture, architecture, economics, education, engineering, English, entomology, geology, history, political science, mathematics, modern languages, psychology, rural sociology, sociology, and statistics. In these fields there are more than 75 courses offered.

The Correspondence Bureau also has a program of four high school courses—English review, review of elementary algebra, solid geometry, and plane geometry. These non-credit courses give high school graduates an opportunity to fullfill the college entrance requirements and also assist persons who make low scores on their entrance examinations.

Other correspondence courses may be taken for professional credit rather than college credit.

Evening College

The Evening College is another Extension Division service. Each fall and spring semester, a series of college credit courses is presented on the State College campus for residents of the Raleigh area. In addition, there are offerings of hobby and vocational classes. Similar courses are offered in communities where the demand is sufficiently great and other courses are conducted at military bases in North Carolina.

The Evening College offers resident credit for extension night class work and its program allows persons to work towards a degree.

The Extension Division conducts a series of night classes in sub-freshman mathematics on the State College campus.

Short Courses and Conferences

A wide variety of short courses and conferences are planned each year by the Extension Division in cooperation with several State College schools.

Among these specialized courses are those designed for electrical meter engineers, veterinarians, sawmill operators, pest control operators, clay plant operators, gas plant operators, dry kiln operators, nurserymen, and artificial breeders.

Included among the other short courses offered annually are the cattlemen's conference, dairymen's conference, swine conference, pesticide school, and the State garden schools plus courses in statistical quality control, furniture finishing, grain marketing, farm and small business income tax, sport fishing, job evaluation, quality control, cotton classing, warm air heating and air conditioning and a short course for commercial flower growers.

Other programs available are dairy herd testing, nutrition school, oil burner schools, textile conferences, quality concrete conference, North Carolina press mechanical conference, short courses in modern farming, industry research conference, safety school, nuclear engineering courses, and scores of other programs which benefit trade and professional groups.

Other courses offered are or pertain to improving managerial capacity, egg industry, pest control operators, soft frozen dairy products, industrial engineering seminar, surveying, state highway conference, public works conference, roofing and sheet metal forum, southeastern park and recreation training institute, industrial ventilation conference, electrical supervisors, plumbing inspectors, maintenance of commercial vehicles, stop watch time study, fire alarm superintendents and professional driver training. 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 Institute and its currciula is available upon request. The North Carolina Truck Driver Training School conducts 12 fourweek 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.





DESCRIPTION OF COURSES

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 two 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 (number on the left) of lecture and for two hours (number on the right) of laboratory work each week. The f s designation (fall semester and spring semester respectively) indicates that the course may be taken either during the fall or spring semester.

Agricultural Economics

Courses for Undergraduates

AGC 212 Economics of Agriculture

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 Prerequisite: AGC 212

An application of basic economic principles and techniques to the problems facing a farm business; use of budgeting, programming, systems analysis and other modern techniques to determine what, how, and how much to produce when faced with numerous alternatives; analysis of problems associated with firm size and the acquisition of adequate resources; use and analysis of farm records as an aid to better management. Two all-day Saturday field trips are required of all students. Messrs. Ihnen, Hoover

3 (3-0) f s

3 (2-2) f s

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 monoply 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. Students are expected to individually examine the marketing problems associated with the commodity of their choice.

AGC 322 Organization and Management of Cooperatives 2 (2-0) s Prerequisite: AGC 212

A study of the principles of cooperation applied to farmers' purchasing, marketing, and service cooperatives; the role of cooperatives in our society, and problems associated with organization, operation, and management.

(Offered in Spring 1963 and alternate years)

Mr. King

Courses for Advanced Undergraduates

AGC 413 Farm Appraisal and Finance

Prerequisite: AGC 303

Examination of the source of productivity and value of farm inputs; a critical analysis of, and practice in the use of, farm appraisal procedures currently used for land and buildings; review of the sources of, and repayment practices used in, short and intermediate credit in agriculture; consideration of the forces operating in the whole economy with an examination of the implications of these changes for both the lender and borrower in agriculture. Mr. Hoover

AGC 431 Agricultural Price Analysis

Prerequisite: AGC 212 Principles of price formation; the role of prices in the determination of economic activity; the interaction of cash and futures prices for agricultural commodities; methods of price analysis, construction of index numbers, analysis of time series data including the estimation of trend and seasonal variations in prices.

Courses for Graduates and Advanced Undergraduates

AGC 512 Economic Analysis of Agricultural Factor Markets 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 their behavior of marketing firms; methods for increasing the efficiency of marketing agricultural products. Mr. King

AGC 523 Planning Farm and Area Adjustments Prerequisite: AGC 303 or equivalent

3 (2-2) f

The application of economic principles in the solution of production problems on typical farms in the state; methods and techniques of economic analysis of the farm business;

3 (2-3) s

3 (3-0) f

3 (3-0) s

application of research findings to production decisions; development of area agricultural programs. Mr. Coutu

AGC 533 Agricultural Policy

Prerequisite: AGC 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, and some of the international aspects of United States agricultural policy; the attempts at world market regulations, and the role of international organizations, agreements, and programs.

AGC 551 Agricultural Production Economics

Prerequisite: AGC 212

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

3 (3-0) s

3 (3-0) f

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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

Seminar in Contemporary Economic Problems in Agriculture AGC 561 Maximum 6 Prerequisite: 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. Staff

Courses for Graduate Students Only

AGC 602 Monetary and Fiscal Policies in Relation to Agriculture 3 (3-0) s Prerequisite or corequisite: EC 501 or equivalent

The essentials of monetary theory necessary in interpreting and evaluating monetary and fiscal operations and policies as to their effect upon income, employment, and price level; the monetary and fiscal structure, and the mechanics of monetary and fiscal operations in the United States; and the relation of monetary and fiscal policies to agricultural income and prices. Mr. Tolley

International Trade in Relation to Agriculture AGC 612

Prerequisites or corequisites: AGC 602 and 641

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

AGC 621 **Research in Agricultural Economics**

Prerequisite: Graduate standing in Agricultural Economics and consent of Graduate Advisory Committee

A consideration of research methods and procedures employed in the field of agricultural economics, including qualitative and quantitative analysis, inductive and deductive methods of research procedure, selection of projects, planning and execution of the research project. Staff

Economic and Social Foundations of Agricultural Policy AGC 631 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. Staff

3 (3-0) s

Credits by arrangement

AGC 632 Welfare Effects of Agricultural Policies and Programs 3 (3-0) s 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 allocations, income distribution, and economic development of agriculture. Mr. Bishop

Economics of Production, Supply and Market Interdependency AGC 641 3 (3-0) s Prerequisite or corequisite: EC 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

Economics of Consumption, Demand and Market Interdependency AGC 642 3 (3-0) f Prerequisites: AGC 641 and ST 513 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

Prerequisites: ST 421, ST 502, and AGC 642

The role and uses of statistical inference in agricultural economic research; measurement problems and their solutions arising from the statistical model and the nature of the data; limitations and interpretation of results of economic measurement from statistical techniques. Topics include the problems of specification, aggregation, identification, multicolinearity and autocorrelation. Attention also is given to expectations models and simultaneous stochastic Mr. Wallace equations.

AGC 652 (ST 652) Econometric Methods II Prerequisites: ST 522 and AGC 551

Techniques for problem analysis in agricultural economics; attention to analysis of time series data; non-parametric inference; experimental design in economic research; estimation of parameters in production functions and in simultaneous models; selected special topics.

Mr. Anderson

Analysis of Economic Development in Agriculture AGC 671

Prerequisite: AGC 641

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S 8.

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 Education

(See Education)

Agricultural Engineering

Courses for Undergraduates

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AGE 151, 152 Farm Mechanics

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 Mr. Blum the utilization of such materials and processes.

2 (1-3) f s

3 (3-0) s

3 (3-0) f

3 (3-0) f

Agricultural Construction and Maintenance I 2 (1-3) f s AGE 201 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 Messrs, Howell, Blum such information is included.

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

3 (2-2) f s Farm Power and Machinery I AGE 211 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. Staff

3 (2-2) +

Courses for Advanced Undergraduates

AGE 303 **Energy Conversion for Agricultural Production**

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

Prerequisite: Junior standing

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 vegetable programs. Staff

AGE 331 (FS 331) Food Engineering

Prerequisite: PY 211

Fundamentals of power application in the processing and preservation of perishable food products. Mr. Jones

AGE 332 Farm Buildings and Crop Processing

Prerequisite: Junior standing

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

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

Prerequisites: CE 201, SSC 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. Wiseı

AGE 401 **Problems in Farm Mechanics**

Prerequisites:. AGE 201, 202, Enrollment in Agricultural Education

3 (2-2) \$

2 (2-0) s

3 (2-3) \$

3 (2-3) s

3 (2-2) f

4 (3-3) s

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

Farm Power and Machinery IIB AGE 411

Prerequisite: AGE 211

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This course is designed to provide students in Agricultural Engineering Technology with a knowledge of the operations of manufacturing and distribution 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

Conditioning Principles for Plant and Animal Systems AGE 451 2 (2-0) 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

3(2-3) f s

AGE 452 Senior Seminar

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 Mr. Hassler during the semester. Maximum of two credits allowed.

AGE 462 Farm Power and Machinery IIA

Prerequisites: AGE 211, EM 301

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

Agricultural Structures as Production Units AGE 481

Prerequisites: AGE 451, EM 301

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 Mr. Jordan the design procedures for a sound, functional building.

AGE 491 Rural Electrification

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

Special Problems AGE 551

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 Mr. Hassler, Staff study in Agricultural Engineering.

AGE 552 Instrumentation for Agricultural Research and Processing 1 (0-2) f Prerequisites: EE 320, MA 301

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. Splinter

4 (3-3) f

4 (3-3) s

1 (1-0) s

4 (3-3) f

Credits by arrangement

Credits by arrangement

Courses for Graduates Only

Research in Agricultural Engineering AGE 651 Prerequisite: Graduate standing in Agricultural Engineering

A maximum of six credits is allowed toward a master's degree; no limitation on credits for doctorate program.

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. Graduate Staff

AGE 652 Seminar

Prerequisite: Graduate standing

A maximum of two credits is allowed.

Elaboration of the subject areas, techniques and methods peculiar to professional interest through presentations of personal and published works; opportunity for students to present and defend, critically, ideas, concepts and inferences. Discussions to point up analytical solutions and analogies between problems in Agricultural Engineering and other technologies, and to present the relationship of Agricultural Engineering to the socioeconomic enterprise. Mr. Hassler

1 (1-0) f s

AGE 654 Agricultural Process Engineering

Prerequisite: MA 511

Generalized classical thermodynamics is extended by Onsager's relations to provide a theoretical basis for analyzing the energetics of systems that include life processes.

Mr. Johnson

3 (3-0) f s

Analysis of Function and Design of Farm Machinery AGE 661 3 (2-3) f or s Prerequisite: PY 401

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

Theory of Drainage Irrigation and Erosion Control AGE 671 4 (3-3) f or s

Prerequisite: MA 512

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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

Analysis of Function and Design of Farm Buildings AGE 681

Prerequisite: AGE 481

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. Mr. Jordan

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.

AC 311 Agricultural Communications Methods and Media

Prerequisites: ENG 111 and 112

Designed to give an insight into the communications process; written, oral and visual techniques of communications; a survey of the channels of communications available; and techniques for using these channels individually or combined into a publicity or public relations information program. Mr. Carpenter

4(4-0) f or s

3 (3-0) s

Principles and Methods of Extension Education AG 401

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) 🖸 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.

3 (3-0) s

AS 122 Air Science I

An introductory examination of the factors of aerospace power, major ideological conflicts, requirements for military forces in being, responsibilities of citizenship, development and traditions of the military profession, role and attributes of the professional officer in American democracy, organization of the armed forces as factors in the preservation of national security, and the United States Air Force as a major factor in the security of the free world.

AS 221 Air Science II

An introductory survey of aerospace missiles and craft, and their propulsion and guidance systems; target intelligence and electronic warfare; nuclear, chemical and biological warhead agents; defensive, strategic and tactical operations; problems, mechanics and military implications of space operations; and a survey of contemporary military thought.

AS 222 Air Science II

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 III

Prerequisites: Basic Air Science Courses

Instruction deals with staff organization and functions, and the skills required for effective staff work, including oral and written communications and problem solving; basic psychological and sociological principles of leadership and their application to leadership practice and problems. Classroom requirements will be partially met by the satisfactory completion of either SOC-301, SOC-501, or EC-426.

AS 322 Air Science III

Study continues in principles of leadership, and instruction includes communicating and instructing in the Air Force and an introduction to military justice.

AS 421 Air Science IV

Prerequisite: Air Science III Instruction deals with weather and navigation, a flying instruction program, and an intensive study of global relations of special concern to the Air Force officer with emphasis on international relations and geography.

1(2-1) s

1 (0-1) s

1 (2-1) f

1 (2-1) f

2 (3-1) s

2 (3-1) f

1 (2-1) s AS 422 Air Science IV The study of the military aspects of world political geography continues; course includes 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.

Summer Training Unit

An integral part of the Advanced Course is the Summer Training Unit, a four-week encampment at an active Air Force Base. During the summer encampment a cadet is trained in the use of weapons, in close-order drill; he will participate in physical training, competitive sports, orientation flying and will become familiar with aerospace vehicles and emergency equipment; he will observe at first hand various organizations on the base in the performance of their everyday operations. Normally a student enrolled in the advanced course will attend a Summer Training Unit between his junior and senior years; under unusual circumstances, attendance can be postponed until the summer following completion of degree requirements.

Animal Science

Courses for Undergraduates

ANS 201 Elements of Dairy Science 4(3-3) fs 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. Mr. Everett

ANS 202 Fundamentals of Animal Husbandry

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

ANS 302 Selecting Dairy and Meat Animals

A study of dairy and meat animals including desired characteristics in breeding and market animals and relating to productive performance. Market classes and grades of beef cattle, sheep and swine and relation of live animal grade to carcass grade will be studied. Herd book study, pedigree evaluation and breed history and organization will be included.

Messrs. Murley and Gregory

ANS 303 (FS 303) Meat and Meat Products

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

ANS 308 Advanced Selecting Dairy and Meat Animals

Prerequisite: ANS 302

Intensive practice on developing proficiency in selecting techniques for dairy and meat animals with emphasis on oral reasons. Visits will be made to leading farms to study different breeds. Messrs. Murley, Gregory

(FS 309) Meat Selection ANS 309

Detailed consideration of factors involved in selection of carcasses and wholesale cuts of beef, pork and lamb. Practice in identification of wholesale and retail cuts. Mr. Blumer

Principles of Livestock Nutrition ANS 312

Prerequisites: CH 431, ZO 301

Fundamentals of modern animal nutrition, including classification of nutrients, their general metabolism and roles in productive functions. Mr. Ramsey

3 (2-3) s

1 (0-3) s

1 (0-6) f

3 (3-0) s

4(3-3) f s

2 (0-6) f

ANS 404 Dairy Farm Problems

Prerequisite: ANS 201 Advanced study of practical dairy farm management including farm records, farm buildings, sanitation, roughage utilization and herd culling. Mr. Murley

ANS 406 Animal Science Seminar 1 (1-0) s Review and discussion of special topics and the current literature pertaining to all phases of animal science. Mr. Porterfield

ANS 407 Advanced Livestock Production

Prerequisites: GN 411 and ANS 312

A study of the economic, nutritional, genetic, physiological and managerial factors affecting the operation of commercial and purebred livestock enterprises. Mr. Barrick

ANS 408 **Reproduction and Lactation**

Prerequisite: ZO 301

Anatomy of the reproductive organs and mammary glands with detailed coverage of the physiological processes involved and of factors controlling and influencing them. A special research problem selected by the student is required. Messrs. Mochrie, Myers, Ulberg

3 (2-3) s

4 (3-3) s

3 (2-3) s

Courses for Graduates and Advanced Undergraduates

ANS 503 (GN 503) Genetic Improvement of Livestock

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 cross-Mr. Robison breeding in a program of animal improvement.

ANS 505 Diseases of Farm Animals

Prerequisites: CH 101, CH 203; BO 421 desired

The pathology of bacterial, virus, parasitic, nutritional and thermal diseases, and mechanical Mr. Batte disease processes.

ANS 507 Topical Problems in Animal Science Special problems may be selected or assigned in various phases of Animal Science. A maximum Staff of six credits is allowed.

ANS 513 Needs and Utilization of Nutrients by Livestock

Prerequisite: ANS 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

Credits by arrangement f s ANS 600 Research in Animal Science A maximum of six hours is allowed toward the master's degree; no limitation on credits in doctorate programs.

ANS 601 Seminar in Animal Nutrition

Prerequisite: Permission of seminar leaders

Orientation in philosophy of research; preparation for research in agriculture, and general Nutrition Staff research methodology.

ANS 602 (GN 602) Population Genetics in Animal Improvement 3 (Arranged) f Prerequisites: ST 512 and GN 512

A study of the forces influencing gene frequencies, inbreeding and its effects, and alternative Mr. Legates breeding plans.

1 (1-0) f s

Maximum 6 f s

3 (3-0) s

3 (3-0) f

3 (2-3) f

ANS 603 Animal Nutrition: Mineral Metabolism Prerequisite: CH 551

Principles of mineral metabolism with emphasis on metabolic functions, reaction on mechan-Mr. Matrone isms and interrelationships.

ANS 604 (ZO 604) Experimental Animal Physiology

Prerequisite: ZO 513 or equivalent A study of the theories and techniques involved in the use of animals in physiological investi-Messrs. Ulberg, Wise gation.

(BO 614) Bacterial Metabolism ANS 614

Prerequisites: BO 514 or equivalent and CH 551

The energy metabolism of bacteria; synthesis of carbohydrates, lipids, proteins, purines, pyrimidines, and nucleic acids; bacterial photosynthesis; enzyme formation and metabolic control mechanisms; active transport systems. Mr. McNeill

(CH 621) Enzymes and Intermediary Metabolism 4 (3-4) f ANS 621 Prerequisites: CH 511 and permission of instructor A study of the properties of enzymes and enzyme action; intermediary metabolism of carbohydrates, lipids, fatty acids, vitamins, purines and phorphrins; metabolic energy relation-Mr. Tove ships.

3 (3-0) f

4 (2-4) f

3 (2-3) s

ANS 622 (CH 622, ST 622) Principles of Biological Assays 3 (2-2) s Prerequisites: CH 551 and ST 512

Techniques and designs of biological assays for vitamins. The interrelationship of logical principles, design and analysis is emphasized. Messrs. Smart, Tove

Anthropology

(Also see Sociology)

Courses for Undergraduates

Physical Anthropology ANT 251

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The study of the development of man as a species; analysis of the formation and spread of races; introduction to archaeology as a study of the material remains of ancient man and his activities.

ANT 252 Cultural Anthropology

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

Prerequisites: SOC 202, SOC 301 or equivalent

The study of major anthropological theories of culture with intensive analysis of their application.

Architecture

Courses for Undergraduates

3 (3-0) f

3 (3-0) s

3 (3-0) f

ARC 201, 202 Architectural Design I, II

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. Boaz, Buisson, Clarke, Waugh, Wurman

ARC 300 Historic Architecture Research

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. Shogren

ARC 301, 302 Architectural Design III, IV 6 (3-12) f s Prerequisites: ARC 202, EM 200, 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 constructions.

Messrs. Harris, Shawcroft, Shogren

4 (3-6) f s

2 credits s

ARC 312 Materials and Specifications

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 377, 378 Environmental Factors

An investigation of environmental factors affecting architectural design. Heating and cooling systems; and controls and principles of plumbing including venting, drainage, demand and load calculations, water distribution, pipe sizing, storm drainage and sprinkler systems in first semester. Lighting and acoustical design and electrical equipment and design in second Mr. Kahn semester.

ARC 401, 402 Architectural Design V, VI

Prerequisites: ARC 302, CE 339, EM 301

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. Harris

ARC 421, 422 Structural Design I, II

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

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 Mr. Glowczewski in the spring semester.

ARC 511 Professional Practice

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. Boaz

ARC 531, 532 Structural Design III, IV

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

3 (3-0)

3 (3-3) f s

7,9 (3-12) f s

6 (3-12) f s

2 (2-0) f

2 (2-2) f s

Biology

3 (3-0) s BS 301 Fundamentals of Biology 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.

Staff

Botany and Bacteriology

Courses for Undergraduates

4 (3-2) f s BO 103 General Botany An introduction to the field of Botany. Emphasis is placed on the structure, physiology and sexual reproduction of green and non-green plants and on the principles of heredity and ecology as they apply to these groups. The course may serve as a terminal course or as an introduction prior to further study in Botany. Mr. Cooper

Aquatic Vascular Plants BO 201

Prerequisite: BO 103

A comprehensive survey of marsh and aquatic vascular plants with emphasis on identification and habitat relationships. (Offered in alternate years. Given in 1962-63.) Mr. Beal

BO 214 Dendrology

Prerequisite: BO 103

A systematic survey of the evergreen (gymnosperm) and hardwood (angiosperm) genera and species of North American trees. Emphasis is upon terminology, structure, relationships, and identification of woody plants. Mr. Hardin

BO 301 General Morphology

Prerequisite: BO 103 or equivalent

A survey of the principal groups of plants from the standpoint of their structure, development and reproduction. Emphasis is placed on 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 the plants in their native habitats. Mr. Hardin

BO 403 Systematic Botany

Prerequisite: BO 103

A systematic survey of vascular plants emphasizing field identification, terminology, and general evolutionary relationships. Mr. Beal

BO 412 General Bacteriology

Prerequisites: CH 103 or 107 (CH 221, 215 or 411 recommended but not required)

An advanced biology course dealing with bacteria and other microorganisms, their structure, development, and function. Emphasis is placed on the fundamental concepts and techniques in microbiology such as isolation, cultivation, observation, morphology, and the physiology and nutrition of bacteria. The applications of microbiology, the role of microbes in nature, and their role in infection and immunity are considered. Mr. Elkan

BO 421 Plant Physiology

Prerequisites: BO 103, 2 courses in chemistry

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 and Troyer

BO 441 Plant Ecology

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

2 (1-2) f

4 (2-4) s

3 (2-3) f

3 (0-6) s

4 (2-4) f

4 (2-4) f s

3 (2-3) f

Courses for Graduates and Advanced Undergraduates

BO 505 (FS 505) Food Microbiology

BO 511 Advanced Bacteriology

Prerequisites: BO 412, CH 220, 221 or 223

This course will present the principles and techniques of isolation and characterization of bacteria from a wide range of habitats. Particular stress will be given to the principles of enrichment techniques, differential and selective media, and pertinent diagnostic tests that are applicable to particular groups of bacteria. Messrs. Evans and Elkan

BO 512 Morphology of Vascular Plants

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

3 (1-4) s

3 (1-6) f

BO 513 Plant Anatomy

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

Introductory Bacterial Physiology BO 514

Prerequisites: BO 412, CH 220, 221 or 223; CH 351 or 551 (May be taken concurrently.) Emphasis will be placed on general principles and function with respect to the living cell. Included will be a study of cell structure, growth, death, reproduction, nutrition, and metabolism. An attempt will be made to illustrate the application of basic principles to applied areas of bacteriology and to other areas of basic science. Mr. Evans

Systematic Botany of Monocot Families BO 521

Prerequisites: BO 103, 403

A comprehensive survey of the systematics and evolution of monocot families. Special emphasis is given to terminology, morphology, identification and relationships. (Offered alternate years. Not given in 1962-63.) Mr. Beal

BO 523 Systematic Botany of Dicot Families

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 alternate years. Given in 1962-63.) Mr. Hardin

BO 531 (SOI 532) Soil Microbiology

BO 534 Physiology of Plant Cells

Prerequisite: BO 421 or equivalent. Advanced preparation in chemistry or physics may be substituted with the permission of the instructor.

An advanced treatment of basic plant processes at the cellular level with emphasis on theoreti-Mr. Troyer cal principles.

2 (2-0) s BO 535 Water, Solute, and Gas Relations of Plants

Prerequisite: BO 534

An advanced treatment of processes of higher plants involving exchange of materials between the plant and its surroundings and movement of materials within the plant. Theoretical principles are emphasized. (Offered alternate years. Given in 1962-63.) Mr. Troyer

BO 536 Growth and Development of Plants

Prerequisite: BO 534

An advanced treatment of the physiology of growth and development of higher plants, with emphasis on theoretical principles. (Offered alternate years. Not given in 1962-63.)

3 (1-6) s

3 (0-6) f

3 (2-3) f

3 (3-0) f

2

3 (3-0) f

Mr. Tro	yer
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3 (3-0) s

2 (2-0) s

BO 544 Plant Geography

Prerequisites: BO 403, 441, GN 441, or equivalents

A course in descriptive and interpretive plant geography, synthesizing data from the fields of ecology, genetics, geography, paleobotany, and taxonomy. The course will include a survey of the present distribution of major vegetation types throughout the world, a discussion of the history and development of this present pattern of vegetation, and a discussion of the principles and theories of plant geography. (Offered alternate years. Given in 1962-63.)

Mr. Cooper

Advanced Plant Ecology BO 545

Prerequisites: BO 421, 441 or equivalents

An advanced consideration, through class discussions and individual projects, of the principles, Mr. Cooper theories and methods of plant ecology.

BO 570 (CE 570) Sanitary Microbiology

Prerequisites: AGE 211, EM 321 Fundamental aspects of microbiology and biochemistry are presented and related to problems of stream pollution, refuse disposal and biological treatment. Laboratory exercises present basic microbiological techniques and illustrate from a chemical viewpoint some of the basic microbial aspects of waste disposal. Mr. Elkan

3 (2-3) s

3 (2-3) s

BO 574 Phycology

Prerequisite: BO 103 or equivalent

A systematic study of the structure and classification of the algae, both fresh-water and marine. The life history and ecology of important local species will be emphasized.

Mr. Whitford

3 (1-4) s

Courses for Graduates Only

BO 614 (ANS 614) Bacterial Metabolism

BO 620 Advanced Taxonomy

Prerequisites: BO 521, 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. Mr. Hardin

BO 632 (SSC 632) Advanced Soil Microbiology

BO 635 The Mineral Nutrition of Plants

Prerequisites: BO 421 and a course in Biochemistry

Discussion of diffusion, molecular specificity and energetics of active transport. The physical chemistry of the essential elements and its significance to their biochemical functions.

Mr. Kahn

Discussions in Plant Physiology BO 636

Prerequisite: BO 534

Group discussions at an advanced level of selected topics of current interest in plant physiology. Mr. Troyer

BO 640 Special Problems in Bacteriology

Credits by arrangement f s Directed research in some specialized phase of bacteriology other than a thesis problem but designed to provide experience and training in research. Graduate Staff

BO 641 Research in Bacteriology

Original research preparatory to writing a master's thesis or a Ph.D. dissertation.

Graduate Staff

Credits by arrangement f s

3 (2-3) s

1 (1-0) s

3 (2-2) s

Credits by arrangement f s Special Problems in Botany BO 650 Directed research in some specialized phase of botany other than a thesis problem but designed to provide experience and training in research. Graduate Staff

Research in Botany BO 651

Credits by arrangement 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 sSpecific 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

1(1-0) f s**Botany Seminar** BO 661 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 pre-Graduate Staff sented at seminar.
Ceramic Engineering

Courses for Undergraduates

3(2-3) f sMIC 210 Ceramic Materials and Processes 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

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. Lecture and Laboratory.

MIC 302 Ceramic Operations II

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 calculations, furnaces, kilns and kiln calculations. Lecture and Laboratory.

MIC 312 Ceramic Process Principles I

Corequisite: MIC 302

Effect of heat on non-metallic minerals. Thermodynamic calculations. Industrial fuels and combustion, review of heterogeneous equilibria. Crystal structures. Pyrochemical and pyrophysical changes in ceramic bodies. Lecture and Laboratory.

MIC 413 Ceramic Process Principles II

Prerequisites: MIG 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

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 The methods of design of ceramic equipment, structures and plant designing.

4 (3-3) s

4 (3-3) f

3 (2-3) s

4 (3-3) f

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3 (3-0) s MIC 420 Industrial Ceramics 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.

1 (1-0) f s MIC 425 Seminar 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

3 (2-3) f s MIC 503 Ceramic Microscopy Prerequisite: MIC 531 Petrographic techniques for the systematic study of ceramic materials and products. Interpretation and representation of results.

2 (0-6) f s

3(1-6) fs

MIC 505 Research and Control Methods

Prerequisite: MIC 413

Interpretation of results, instrumental methods applied to research and product development. Statistical quality control.

3 (1-6) f s MIC 507, 508 Advanced Ceramic Experiments Prerequisite: MIC 414 or equivalent

Advanced studies in ceramic laboratory experimentation.

MIC 511 Advanced Studies in Firing

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

Prerequisite: MIC 413

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The technology of the structural clay products industries with emphasis on the latest developments in the field.

MIC 527 Refractories in Service

Prerequisite: CH 342

A study of the physical and chemical properties of the more important refractories in respect to their environment in industrial and laboratory furnaces.

MIC 540 Glass Technology

Prerequisite: MIC 413

Fundamentals of glass manufacture including compositions, properties and application of the principle types of commercial glass.

MIC 548 Technology of Cements

Prerequisite: MIC 413

The technology of the Portland cement industry including manufacture, control and uses.

Courses for Graduates Only

MIC 601 Ceramic Phase Relationships

Prerequisite: Consent of Instructor

Heterogeneous equilibrium, phase transformations, dissociation, fusion, lattice energy, defect structures, thermodynamic properties of ionic phases and silicate melts.

MIC 605, 606 Crystal Structures

Prerequisite: CH 342

3 (3-0) s

3 or 3

3 (3-0) s

3 (2-3) s

3 (2-3) f s

3 or 3

3 or 3

Basic laws of crystal structure. Relation of crystal structure to chemical and physical properties.

MIC 613 Ceramic Thermal Mineralogy

Prerequisite: MIC 605 Applications of the principles of thermo-chemical mineralogy to ceramic problems.

MIC 615, 616 High Temperature Technology

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 hightemperature materials.

1 to 9 credits per semester MIC 650 Ceramic Research An original and independent investigation in ceramic engineering. A report of such an investigation is required as a graduate thesis.

1 (1-0) f s MIC 660 Ceramic Engineering Seminar 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.

3 (3-0) s

3 (2-3)

2 (2-0) f s

Chemical Engineering

Courses for Undergraduates

CHE 205 **Chemical Process Principles**

Prerequisites: MA 102, CH 103

Required of sophomores in Chemical Engineering.

The calculation of material and energy balances, stoichiometry, gas laws, vapor pressure, humidity, saturation, themophysics and thermochemistry. Three lectures and one problem period.

CHE 301, 302 Elements of Chemical Engineering 3(3-0) fs 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

Prerequisite: CHE 205

Required of sophomores in Chemical Engineering

A continuation of CHE 205. One laboratory period is devoted to typical chemical engineering measurements.

Unit Operations I CHE 411

Prerequisites: 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

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

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.

4(3-2)f

4 (3-3) s

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3 (3-0) s

3 (3-0) f

4 (3-2) f

CHE 421, 422 Reactor Energy Transfer 3 (3-0) f s Prerequisites: MA 202, PY 202 Required courses in Nuclear Engineering curriculum Thermodynamics, heat transfer and fluid flow with emphasis on problems and methods used in the design and analysis of nuclear reactors.

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

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

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

Prerequisite: CHE 411

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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

Prerequisite: CHE 412

A study of selected chemical processes with emphasis on the engineering, chemical and economic factors involved.

CHE 540 Electrochemical Engineering

Prerequisite: Physical Chemistry

The application of electrochemical principles to such topics as electrolysis, electroanalysis, electroplating, metal refining, etc.

CHE 541 Cellulose Industries

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

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.

3 (3-0) f

3 Arrange f s

1 (1-0) f s

2 Arrange f s

3 (3-0) s

3 (3-0) s

CHE 543 Technology of Plastics

Prerequisite: Organic Chemistry

The properties, methods of manufacture and application of synthetic resins. Recent developments in the field are stressed.

Petroleum Refinery Engineering CHE 545

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 Prerequisite: CHE 415

A basic study of the rates of homogeneous reactions, heterogenous reactions and catalysis.

3 (3-0) s

3 Arrange f

3 (3-0) s

3 (3-0) f

Thermal Problems in Nuclear Engineering CHE 551

Prerequisite: ME 302 or 303 or CHE 411 or equivalent

The design and operation of nuclear reactors and the utilization of the power from them involves major problems in nearly every phase of heat transfer, and many important problems in fluid flow. Possible solutions to these problems are several affected by the influences of radiation on heat transfer media, hazards of handling radioactive substances, etc. The course considers the thermal problems of nuclear reactor design and the principles of fluid flow and heat transfer necessary to their solutions.

The course is intended for engineers and science students with backgrounds in physics and mathematics and elementary thermodynamics.

CHE 553 Separation Processes in Nuclear Engineering

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, absorption 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

Prerequisite or corequisite: CHE 412

A laboratory study of some phase of chemical engineering or allied field.

Courses for Graduates Only

CHE 610 Heat Transfer I

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

Prerequisite: CHE 610 An intensive study of recent advances in heat tranfer and allied fields.

CHE 612 **Diffusional Operations**

Prerequisite: CHE 412

An advanced treatment of mass transfer particularly as applied to absorption, extraction, drying,

3 (3-0) f

2 (2-0) s

3 (3-0) f

3 Arrange f s

3 (3-0)

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3 (3-0)

humidification and dehumidification.

3 (3-0) Distillation CHE 613 Prerequisite: CHE 412 Vapor-liquid equilibria of non-ideal solutions, continuous distillation of binary and multicomponent systems, batch distillation, azeotropic and extraction distillation. Drying of Solids 2 (2-0) CHE 614 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. 3 (3-0) f Thermodynamics I CHE 615 Prerequisite: CHE 415 Advanced topics in Chemical Engineering thermodynamics including equilibria of physical and chemical systems, high pressure systems, generalized properties of hydrocarbons, etc.

CHE 616 Thermodynamics II

Prerequisite: CHE 615 An intensive study of recent advances in thermodynamics. 2 (2-0) s

CHE 617 Catalysis of Industrial Reactions

Prerequisite: CHE 546

A study of the mechanism of catalysis with emphasis on practical application to operation and design of industrial process.

CHE 631, 632 Chemical Process Design

Prerequisite: CHE 412

Design and selection of process equipment, through solution of comprehensive problems involving unit operations, kinetics, thermodynamics, strength of materials and chemistry.

CHE 641, 642 Advanced Chemical Engineering Laboratory 2 Arrange f s

Prerequisite: CHE 412

Advanced laboratory work in a selected field with emphasis on theory, techniques and performance of equipment.

CHE 650 Advanced Topics in Chemical Engineering 1 to 3 credits per semester f s A study of recent developments in chemical engineering theory and practice, such as ion exchange, crystallization, mixing molecular distillation, hydrogenation, fluorination, etc. The topic will vary from term to term.

CHE 660 Chemical Engineering Seminar 1 credit per semester f s Literature investigations and reports of special topics in chemical engineering and allied fields.

CHE 680 Chemical Engineering Research 1 to 9 credits per semester f s Independent investigation of an advanced chemical engineering problem. A report of such an investigation is required as a graduate thesis.

Chemistry

Courses for Undergraduates

CH 101 General Chemistry I

The language of chemistry, fundamental chemical laws and theories, limited study of selected chemical elements, compounds, reactions, and processes.

Messrs. White, Blalock and staff

CH 103 General Chemistry II

Prerequisite: CH 101

Homogeneous and heterogeneous equilibrium, oxidation and reduction, metallurgy, fundamental properties of metals, non-metals and their compounds, introductions to organic and

4 (3-2) f s

4 (3-2) f s

3 (3-0) f s

3 (3-0)

nuclear chemistry, industrial applications of some metals, non-metals and their compounds. The laboratory work is mostly semimicro qualitative analysis.

Messrs. White, Blalock, and staff

CH 105 General Inorganic Chemistry 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. Messrs. Freedman and Jones

CH 106 General Inorganic Chemistry Laboratory 1 (0-3) f Corequisite: CH 105 Laboratory work to supplement the laboratory of CH 105. Staff

CH 107 General Chemistry and Qualitative Analysis

Prerequisite: CH 105

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 mainly semimicro qualitative analysis. Designed for students who plan to take advanced courses in chemistry.

Staff

4 (3-3) f s

4 (3-3) f s

CH 108 General Chemistry and Qualitative Analysis Laboratory	1 (0-3) fs
Corequisite: CH 107	K
Laboratory work to supplement CH 107.	Staff

CH 215 Quantitative Analysis

Prerequisite: CH 103

One semester course in volumetric and gravimetric analysis. Includes techniques, stoichiometry and principles of neutralization, oxidation and precipitation methods and the chemistry of Mr. Oliver representative laboratory determinations.

CH 220 Introductory Organic Chemistry

Prerequisite: CH 103 An introduction to the fundamental principles of organic chemistry included in the study of the hydrocarbons, alcohols, ethers, aldehydes, ketones, acids and derivatives, esters, phenols, fats, carbohydrates, amino acids, proteins, and a selected group of natural and synthetic prod-Mr. Robinson ucts.

CH 221 Organic Chemistry I

Prerequisite: CH 107 or CH 103

Fundamentals of organic chemistry covering both aliphatic and aromatic compounds. Messrs. Loeppert and Reid

CH 222 Organic Chemistry Laboratory	1 (0-3) f
Laboratory work to supplement CH 221	Staff
CH 223 Organic Chemistry II Prerequisite: CH 221	4 (3-3) f s
A continuation of CH 221	Messrs. Loeppert and Reid
CH 224 Organic Chemistry Laboratory Corequisite: CH 223	1 (0-3) s
Laboratory work to supplement CH 223	Staff

CH 231 Introductory Physical Chemistry

Laboratory work to supplement CH 223

Prerequisites: CH 103 and MA 112

Designed for students whose background in mathematics and physics is not sufficient to meet the requirements of the CH 431-433 physical chemistry course, but who desire instruction on chemical principles in addition to that provided at the freshmen level.

Staff

4 (3-3) f s

4 (3-3) f s

4(3-3) fs

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CH 351 Introductory Biochemistry Prerequisite: CH 220 The fundamental chemistry of living matter.

Courses for Advanced Undergraduates

Analytical Chemistry I CH 411 Prerequisites: CH 431, 432; Corequisites: CH 433, 434 An introduction to analytical chemistry, including both classical and modern techniques involving the distribution of a component between phases; for example, gravimetric methods, Messrs. Long and Pinkerton gas chromatography and adsorption.

CH 413 Analytical Chemistry II

Prerequisite: CH 411

A continuation of Analytical Chemistry I with emphasis upon modern approaches to acid-base chemistry, oxidation-reduction, potentiometric methods, and spectrophotometry.

Messrs. Long and Pinkerton

3 (2-3) f s

4 (3-3) f s

Mr. Ingram

4 (2-6) s

4 (2-6) f

CH 420 Organic Preparations

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Prerequisites: Three years of chemistry including CH 223 Experiments selected to acquaint the student with advanced methods and techniques in the preparation of organic substances. Mr. Doak

CH 431-433 Physical Chemistry I and II

Prerequisites: CH 107, MA 202 and PY 202

An intensive study of the states of matter, solutions, colloids, homogeneous and heterogeneous equilibrium, reaction kinetics, electrolysis, conductance, oxidation reactions, and ionic equilbrium. Messrs. Getzen, Bowen, and Sutton

CH 432-434 Physical Chemistry Laboratories

Corequisites: CH 431 and CH 433 Laboratory courses to accompany lecture work in Physical Chemistry I and II respectively. Staff

CH 435 Physical Chemistry III

Prerequisite: CH 433

An intensive study of the structure of atoms and molecules, an introduction to statistics, and selected topics in modern physical chemistry. Staff

CH 441 Colloid Chemistry

Prerequisites: CH 220 and CH 215

Adsorption, preparation, properties, constitution, stability, and application of sols, gels, emulsions, foams, and aerosols; dialysis, Donnan membrane equilibrium. Mr. Getzen

Reading in Honors Chemistry CH 491 Credits by arrangement f s A reading course for exceptionally able students at the senior level. The students will do extensive reading in areas of advanced chemistry and will present written reports of their findings.

Courses for Graduates and Advanced Undergraduates

CH 501 Inorganic Chemistry I

Prerequisite: CH 433

A course in modern inorganic chemistry from the point of view of the chemical bond. Topics covered are: chemical periodicity and its origins in atomic structure; the ionic bond and electronegativity; crystal structure and bonding in ionic solids; the metallic state, conduction and semiconductors; the preparation and properties of illustrative compounds.

3 (1-6) f s

3 (3-0) f s

1 (0-3) f s

3 (3-0) f

3 (2-3) s

Staff

3 (3-0) f

Mr. Pinkerton

CH 503 Inorganic Chemistry II

Prerequisite: CH 501 A continuation of CH 501. Topics covered are: the hydrogen molecule-ion and the theory of the covalent bond; molecular orbitals and hybridization; dipole moments and magnetic properties; the theory of acids and bases; non-aqueous solvents; coordination compounds, carbonyls and quasi-aromatic compounds; and the chemistry of the transition metals, lanthanides and actinides. Mr. Long

CH 511 Chemical Spectroscopy

4 (2-6) f Prerequisite: CH 433 Theory, analytical applications and interpretation of spectra as applied to chemical problems. Major emphasis will be placed upon ultraviolet, visible and infrared spectra.

Mr. Long

CH 512 (TC 512) Chemistry of High Polymers

3 (3-0) s

CH 513 Electroanalytical Chemistry

Prerequisite: CH 413

A course in electroanalytical chemistry including the foundations of theoretical electrochemistry. Topics covered are: Potentiometric measurements and electrical resistance; diffusion, transport; theory of dilute solutions; polarography and amperometric measurements; surface effects and electrode kinetics; electrochemistry in non-aqueous systems.

Mr. Pinkerton

3 (3-0) f

4 (3-3) s

CH 521 Advanced Organic Chemistry I Resonance, reaction mechanisms; hydrocarbons, organic halides, alcohols, amines, and carbonyl Mr. Doak compounds.

3 (3-0) s CH 523 Advanced Organic Chemistry II Stereochemistry, steroids and other natural products, organometallics, and heterocycles.

Physical Organic Chemistry CH 525

Prerequisites: CH 223 and CH 433

Theoretical and physical aspects of organic chemistry; structure and mechanism in organic Mr. Loeppert chemistry.

CH 527 Chemistry of Metal-Organic Compounds

Prerequisites: Three years of chemistry including CH 223 A study of the preparation, properties and reactions of compounds containing the carbonmetal bond, with a brief description of their uses. Mr. Doak

CH 528 Qualitative Organic Analysis

Prerequisites: Three years of chemistry including CH 223

A study of class reactions, functional groups, separation, identification and preparation of Staff derivatives.

CH 529 Quantitative Organic Analysis

Prerequisites: CH 223 and CH 413

Quantitative determination of carbon, hydrogen, nitrogen, the halogens, sulfur and various functional groups in organic materials, with emphasis on semimicro methods.

Staff

3 (3-0) f

CH 531 Chemical Thermodynamics Prerequisites: CH 433 and MA 301

An extension of elementary principles to the treatment of ideal and real gases, ideal solutions, electrolytic solutions, galvanic cells, surface systems, and irreversible processes. An introduction to statistical thermodynamics and the estimation of thermodynamic functions from Mr. Sutton spectroscopic data.

Mr. Doak

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3 (3-0) s

3 (1-6) f

3 (1-6) s

3 (3-0) f

CH 533 Chemical Kinetics

Prerequisites: CH 433 and MA 301

An intensive survey of the basic principles of chemical kinetics with emphasis on experimental and mathematical techniques, elements of the kinetic theory, and theory of the transition state. Applications to gas reactions, reactions in solution, and mechanism studies. Mr. Bowen

CH 535 Surface Phenomena

Prerequisites: CH 433 and MA 301

An intensive survey of the topics of current interest in surface phenomena. This course is designed to cover the foundations of the present understanding of surface behavior. Formulation of basic theories are presented together with illustrations of their current applica-Mr. Getzen tions.

CH 537 Quantum Chemistry

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Prerequisites: CH 435, PY 401 and PY 407 The elements of wave mechanics applied to stationary energy states and time dependent phenomena. Applications of quantum theory to chemistry, particularly chemical bonds.

Mr. Coots

3 (3-0) s

3 (3-0) s

3 (3-0) s

CH 543 Radioisotope Principles 3 (3-0) ₽ Prerequisites: CH 433, PY 202 and 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 544 Radioisotope Techniques 1 (0-3) f Corequisite: CH 543 A laboratory course in the physical and chemical techniques essential to competence in the use of radioisotopes. Mr. Coots CH 545 Radiochemistry 3 (3-0) s Prerequisites: CH 543, or PY 407 and PY 410 An advanced presentation of the applications of radioactivity to chemistry and of the applications of chemistry to the radioactive elements, particularly the heavy elements and fission products. Mr. Coots CH 546 Radiochemistry Laboratory 1 (0-3) s Corequisite: CH 545 The laboratory work associated with CH 545 Radiochemistry. Mr. Coots CH 551 **General Biological Chemistry** 5 (3-6) f Prerequisites: 3 years of chemistry including CH 223 The chemical constitution of living matter. Biochemical processes as well as compounds are studied. Mr. Peterson CH 553 Chemistry of Proteins and Nucleic Acids 3 (3-0) s Prerequisite: CH 551 Composition, distribution, structure, properties and metabolism of amino acids, proteins and nucleic acids. Mr. Armstrong 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 plant products. Mr. Sisler

Courses for Graduates Only

(ANS 621) Enzymes and Intermediary Metabolism CH 621 4 (3-0) s Prerequisite: CH 551

A study of the properties of enzymes and enzyme action, intermediary metabolism of carbohydrates, amino acids, fatty acids, vitamins, purines and porphrins, metabolic energy relationships. Mr. Tove

CH 622 (ANS 622) Principles of Biological Assays 3 (2-2) s Prerequisites: CH 551 or ANS 312 and ST 512 Techniques and designs of biological assays for vitamins; interrelationships of logical principles, design, and analysis is emphasized. Staff

CH 631 Chemical Research

Credits by arrangements f s Prerequisites: Forty semester credits in chemistry. Open to all graduates. Special problems that will furnish material for a thesis. A maximum of 6 semester credits is allowed toward a master's degree, no limitation on credits in doctorate programs. Staff

CH 641 Seminar

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Prerequisite: Graduate standing in chemistry.

Required of graduate students specializing in chemistry.

Scientific articles, progress reports in research, and special problems of interest to chemists are reviewed and discussed.

A maximum of two semester credits is allowed toward the master's degree, but any number toward the doctorate. Staff

Credits by arrangement f s

CHEMISTRY

259

CH 651 Special Topics in Chemistry

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. Staff

CH 671 Advanced Physical Chemistry

Prerequisite: CH 533

Involves a thorough review of the fundamental principles of physical chemistry with extension and application of these to the study of solid state. Mr. Sutton

CH 672 Advanced Physical Chemistry

Prerequisite: CH 671

There will be laid down the elements of statistical mechanics and kinetic theory, in terms of which certain topics from CH 671 will be more exhaustively developed. Mr. Sutton

Civil Engineering

Courses for Undergraduates

CE 201 Surveying I

Prerequisite: MA 101

Required of sophomores in Civil Engineering, Civil Engineering Construction Option, Forestry, and juniors in Geological Engineering

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

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

Prerequisite: CE 202

Transporation systems; elements of railroad, highway, traffic and airport engineering; physical and mechanical properties of soil that govern their use as engineering materials.

Maximum 3 credits f s

3 (3-0) s

3(2-3) f s

3 (3-0) f

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3 (2-3) s

CE 321 Materials Testing Laboratory I

Prerequisite: EM 200

Physical properties of aggregates. Manufacture and chemical properties of cementing agents. Physical properties of wet and hardened concretes; design and proportioning of concrete mixes; tensile, compressive, and flexural properties of plain and reinforced concrete.

CE 322 Materials Testing Laboratory II

Corequisite: EM 301

Properties of clay and cement masonary units. Growth, structure and mechanical properties of various species of wood. Production and mechanical properties of structural metals; elastic and plastic tensile properties of steel. Test of riveted and welded joints.

CE 324 Structural Analysis I

Prerequisite: EM 200; Corequisite: EM 301

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.

2 (1-3) f s

2 (1-3) f s

3(2-2) f s

3 (2-3) s

CIVIL ENGINEERING 261

CE 338 Structures I

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Prerequisite: EM 200 Required of juniors in Architecture Analysis of simple structures, reactions, shear and moment diagrams; stresses in numbers of framed structures; graphic statics.

CE 339 Structures II

3 (3-0) : Prerequisites: CE 338 and EM 301 Required of juniors in Architecture Analysis of indeterminate structures; slopes and deflections; analysis of indeterminate frames by moment distribution.

CE 361 **Estimates and Costs I**

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

Prerequisite: CE 361 Required of juniors in Civil Engineering Construction Option Preparation of complete costs estimates of construction projects; bidding procedures and preparation of bids.

CE 382 Hydraulics

Prerequisite: EM 200

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

Prerequisites: CE 324 and EM 301 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

Prerequisites: EM 301 and 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.

3 (2-3) f

4 (3-3) f

3 (3-0) f s

3 (2-3) f

3 (3-0) f

3 (2-3) s

CE 428 Structural Design II

3 (1-6) \$ Prerequisites: CE 427 and 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 Promovisite: CF 497	3 (3-0) s
Required of seniors in Civil Engineering Construction Option Identification and classification of soils; geological aspects of foundation engineerin of investigating subsoil conditions; control of water; type of foundations and favoring their use; legal concepts of foundation engineering.	ng; method conditions
CE 461 Project Planning and Control I Prerequisite: CE 362	3 (2-3) f
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 Prerequisite: CE 461	3 (2-3) s
Required of seniors in Civil Engineering Construction Option Scheduling, analysis and control of construction projects.	
CE 464 Legal Aspects of Contracting Prerequisite: Senior standing	3 (3-0) s
Required of seniors in Civil Engineering Construction Option, elective Legal aspects of construction contract documents and specifications; owner-engineering tractor relationships and responsibilities; bids and contract performance; labor law	neering-con- vs.
CE 481 Hydrology and Drainage Prerequisite: CE 382	2 (2-0) f
Required of seniors in Civil Engineering Occurrence and distribution of rainfall; runoff, surface and ground waters; design and control structures.	of drainage
CE 482 Water and Sewage Works Prerequisite: Senior standing	3 (3-0) s
Required of seniors in Civil Engineering Water supply analysis and design, including population estimates, consumption, s tion aqueducts, distribution systems and pumping stations; elements of water tre lection and disposal of sewage; elements of sewage treatment.	ource selec- atment; col-

CE 485 Elements of Hydraulics and Hydrology

Prerequisite: EM 200

Required of seniors in Civil Engineering and Construction Option Elements of fluid mechanics, hydraulics and hydrology, with application to problems in construction engineering.

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1 (1-0) f s CE 492, 493 Professional Practice I, II 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

3 (2-3) f s CE 507 Airphoto Analysis I Prerequisite: Junior standing Engineering evaluation of aerial photographs, including analysis of soils and surface drainage characteristics.

CE 508 Airphoto Analysis II

Prerequisite: CE 507 Engineering evaluation of aerial photographs for highway and airport projects.

3 (3-0) f

3 (2-3) s

CE 509 Photogrammetry Prerequisite: CE 201	3 (2-3) f s
Elements of photogrammetry as applied to surveying and mapping. Aerial photogrammetry. Flight planning and ground controls. Stereoscopy and stereo instruments. Measurements on photographs.	and terrestrial scopic plotting
CE 510 Advanced Surveying Prerequisite: CE 202	3 (2-3) f s
State coordinate systems and map projections. Elements of geodetic and astronon Adjustment of observations by the method of least squares.	nical surveying.
CE 514 Municipal Engineering Projects Prerequisite: Senior standing	3 (2-3) s
Special problems relating to public works, public utilities, urban planning and ci	ity engineering.
CE 515 Transportation Operations Prerequisite: CE 306 The analysis of traffic and transportation engineering operations.	3 (3-0) f
CE 516 Transportation Design Prerequisite: CE 306 The geometric elements of traffic and transportation engineering design.	3 (2-3) f
CE 524 Analysis and Design of Masonary Structures Corequisite: CE 425 Analysis and design of arches, culverts, dams, foundations and retaining walls	3 (3-0) f 5.
CE 525, 526 Advanced Structural Analysis I, II Prerequisite: CE 425 Analysis of rigid frames and continuous structures; treatment of redundant secondary stresses.	3 (3-0) f s members and
CE 527 Numerical Methods in Structural Analysis Prerequisite: CE 425	3 (3-0) s
Newmark's numerical integration procedure and its applications; matrix operati and iteration, finite difference method. Force and displacement methods, method. High-speed computation.	ions, relaxation string polygon

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CE 531 Experimental Stress Analysis

3 (2-3) f

3 (1-6) s

CIVIL ENGINEERING

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Prerequisite: CE 425 Principles and methods of experimental analysis; dimensional analysis; applications to fullscale structures.

CE 532 Structural Laboratory

Prerequisite: CE 425 Test procedures and limitations and interpretations of experimental results.

3 (3-0) s CE 534 Plastic Analysis and Design

Prerequisite: CE 427

Analysis of steel structure behavior beyond the elastic limit; concept of design for ultimate load and the use of load factors. Analysis and design of component parts of frames. Methods of predicting strength and deformation behavior of structures loaded in the plastic range. Bracing and connection requirements for frames.

3 (3-0) f CE 535 Ultimate Strength Theory and Design Prerequisite: CE 427

Ultimate strength theories of axially loaded column flexure, combined flexure and axial load, shear. Critical review of important research and their relationship with the development of modern design codes for reinforced concrete.

CE 536 Theory and Design of Prestressed Concrete 3 (3-0) s

Prerequisite: CE 427

The principles of prestressed concrete. Materials. Methods of prestressing. Loss of prestress. Design of beams for bending, shear and bond. Ultimate strength. Deflection. Composite beams. Continuous beams. Special topics. Design projects.

CE 544 Foundation Engineering

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

Prerequisite: EM 301

Physical and mechanical properties of soils governing their use for engineering purposes; stress relations and applications to a variety of fundamental problems.

CE 548 **Engineering Properties of Soils I**

Corequisite: CE 442

The study of soil properties that are significant in earthwork engineering, including properties of soil solids, basic clay mineral concepts, classification, identification, plasticity, permeability, capillarity and stabilization. Laboratory work includes classification, permeability and compaction tests.

CE 549 Engineering Properties of Soils II

Prerequisite: CE 548

Continuation of CE 548, including the study of compressibility, stress-strain relations and shear strength theories for soil. Laboratory work includes consolidation and shear strength tests.

CE 570 Sanitary Microbiology

(See BO 570)

CE 571 Theory of Water and Sewage Treatment

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 (3-0) f s

3 (2-3) f

3 (2-3) s

3 (3-0) f

3 (2-3) f s

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3(3-0) f 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

Corequisite: CE 571 Chemical and Physical analysis of water and sewage and interpretation of results.

CE 574 Radioactive Waste Disposal

Prerequisite: PY 410 Unit operations and processes employed in treatment and disposal of radioactive wastes.

CE 580 Flow in Open Channels

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 transition and model studies.

1 (1-0) f s CE 591, 592 Civil Engineering Seminar Discussion and reports of subjects in civil engineering and allied fields.

3 (1-6) f

3 (2-3) f s

3 (3-0) f s

CIVIL ENG	ineering 265
CE 598 Civil Engineering Projects 1 to Special projects in some phases of civil engineering.	o 6 (arrange) f s
Courses for Graduates Only	
CE 601 Transportation Planning Prerequisite: CE 515 The planning, administration, economics and financing of various transports facilities.	3 (2-3) s ation engineering
CE 602 Advanced Transportation Design Prerequisite: CE 516 Design of major traffic and transportation engineering projects.	3 (2-3) s
CE 603 Airport Planning and Design Prerequisites: CE 515 and 516 The analysis, planning and design of air transportation facilities.	3 (2-3) f
CE 604 Urban Transportation Planning Prerequisite: CE 515 Thoroughfare planning as related to land usage and urban master-planning.	3 (2-3) s
CE 623 Theory and Design of Arches 3 (3-0) f Prerequisites: CE 428 and CE 526 General theory of elastic arches. Boundary conditions and their effect on the behavior of the arch. Single span, multiple span arches on elastic piers, influence lines of various functions under moving loads, economical layout of arches, design criteria for steel and concrete arches.	
CE 624 Analysis and Design of Structural Shells and Folded Plates Prerequisites: CE 623 and EM 511 Roof structures consisting of surfaces of revolution, both single and co Membrane stresses, bending stresses at boundaries. Domes and cylindrical she and exact analyses. Design of criteria. Folded plane structures of concrete	3 (3-0) s ompound curved. ells. Approximate plates and steel

3 (2-3) f s CE 625, 626 Advanced Structural Design I, II Prerequisite: CE 428; Corequisites: CE 525 and 526 Complete structural designs of a variety of projects; principles of limit and prestress design.

CE 627 Design of Blast Resistant Structures

Prerequisites: CE 526, CE 535 and EM 554

Sources, intensities, and methods of transmission of dynamic loads. Behavior of structural elements under dynamic loadings. Behavior of structural systems subjected to pulse and impact loads. Design criteria and factor of safety. Design of surface and underground structures for nuclear blasts.

CE 641, 642 Advanced Soil Mechanics

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; soil dynamics.

CE 643 Hydraulics of Ground Water

Prerequisite: CE 442 or 547

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Principles of ground water hydraulics; theory of flow through idealized porous media; the flow net solution; seepage and well problems.

3 (3-0) f

3 (3-0) f s

3 (3-0) f s

CE 671 Advanced Water Supply and Sewerage Prerequisite: CE 482	4 (3-3) f
Problems relating to the design of water supply and sewerage works.	e s lix
CE 672 Advanced Water and Sewage Treatment Prerequisite: CE 482	4 (3-3) s
Problems relating to the treatment of water and sewage.	
CE 673 Industrial Water Supply and Waste Disposal Corequisite: CE 571 Water requirements of industry and the disposal of industrial wastes.	3 (3-0) f s
CE 674 Stream Sanitation Corequisite: CE 571	3 (3-0) f s
Biological, chemical and hydrological factors that affect stream sanitation	on and stream use.
CE 698 Civil Engineering Research Independent investigation of an advanced civil engineering problem; a restigation is required as a meduate thesi	1-6 (arrange) f s report of such an in-

vestigation is required as a graduate thesis.

Crop Science

Courses for Undergraduates

CS 211 Field Crops I

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

CS 311 Field Crops II

Prerequisites: CS 211, SSC 200

Specific problems in field crop production other than forage crops. Discussion of those crops in farm rotations brings together all the major aspects of crop production for different climatic areas. Mr. Lewis

CS 312 Pastures and Forage Crops

Prerequisites: CS 211, SSC 200 recommended

3 (2-2) f s

3 (2-2) f

3 (3-0) s

2 (2-0) s

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

CS 412 Advanced Pastures and Forage Crops

Prerequisite: CS 312

Pasture species and management (cultural treatment) from an international viewpoint, and the inter-relationship of grazing animals on pasture development and management will be emphasized. Natural grassland and the place of special plant species will be considered.

Mr. Gross

CS 413 Plant Breeding

Prerequisite: GN 411

The application of genetic principles to the improvement of economic plants, including discussions of the methods employed in the development and the perpetuation of desirable clones, varieties and hybrids. Mr. Harvey

CS 414 Weeds and Their Control

Prerequisites: CS 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

3 (2-2) f

3 (3-0) s

Courses for Advanced Undergraduates and Graduates

CS 511 Tobacco Technology

Prerequisites: CS 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

2 (2-0) s

CS 521 Special Problems Credits by arrangement Prerequisite: Students admitted only with consent of instructor Special problems in various phases in Crop Science. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research. Graduate Staff

CS 541 (GN 541 or HS 541) Plant Breeding Methods 3 (3-0) f Prerequisites: GN 512, ST 511 recommended

An advanced study of methods of plant breeding as related to principles and concepts of inheritance. Messrs. Haynes, Timothy

CS 542 (GN 542 or HS 542) Plant Breeding Field Procedures

Prerequisite: CS 541 or GN 541 or HS 541 A laboratory and field study of the application of the various plant breeding techniques and methods used in the improvement of economic plants. Mr. Harvey

Courses for Graduates Only

Students are to consult the instructor before registration.

CS 611 Forage Crop Ecology

Prerequisites: CS 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

CS 612 Special Topics in Weed Control

Prerequisites or corequisites: BO 403, BO 532 or 533, CS 414

Detailed examination of current concepts and literature of weed control. The chemistry, physiology, ecology, taxonomy, microbiology, equipment, and techniques used in weed control research will be discussed. Graduate Staff

CS 631 Seminar

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Prerequisite: Graduate standing

Scientific articles, progress reports in research, and special problems of interest to agronomists

2 (2-0) s

2 (2-0) s

2(0-4)

(In Summer Sessions)

1(1-0) fs

reviewed and discussed. A maximum of two credits is allowed toward the master's degree, however, additional credits toward the doctorate are allowed. Graduate Staff

CS 641 Research

Prerequisite: Graduate standing

A maximum of six credits is allowed toward the master's degree, but any number toward the doctorate. Graduate Staff

Design

Courses for Undergraduates

DN 101, 102 Design I, II

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, Bireline, Macomber, Hertzman, Sappenfield, Stuart, Taylor

3 (3-6) f s

Credits by arrangement

color and its effects. DN 311, 312 Advanced Descriptive Drawing I, II Prerequisite: DN 212 Required of third year students in the School of Design

DN 321, 322 History of Architecture I, II

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

2 (0-6) f s DN 411, 412 Advanced Descriptive Drawing III, IV

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, Stuart

DN 421, 422 History of Design, I, II

Prerequisite: HI 246 Required of all students in Architecture and Landscape Architecture Specialized historical studies in design fields.

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DN 111, 112 Descriptive Drawing I, II

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, Cox, Hertzman, Sappenfield, Taylor

DN 121, 122 Technical Drawing I, II

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. Boaz, Buisson, Glowczewski, Sappenfield, Shawcroft, Shogren, Thurlow

DN 211, 212 Descriptive Drawing III, IV

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 Messrs. Cox, Hertzman, Macomber, Sappenfield

Advanced problems in the fields of painting, sculpture, drawing, and graphics. Messrs. Bireline, Cox, Stuart

Messrs. Clarke, Harris

2(0-4) fs

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3 (2-4) f s

2(0-4) fs

2(0-6) f s

3 (3-0) f s

DN 511, 512 Advanced Descriptive Drawing V, VI Prerequisite: DN 412 Required of fifth year students in Landscape Architecture and Product Design

Advanced problems in the fields of painting, sculpture, drawing, and graphics.

Messrs. Bireline, Cox, Joslin, Stuart

Seminar on Ideas in Design DN 541

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

3 (3-0) f s EC 201, 202 Economics Fundamental principles applying to the organization and functioning of our economy.

2 (0-6) f s

3 (3-0) f s

A course dealing with elementary legal concepts, contracts, agency, negotiable instruments,

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3 (3-0) f or s

3 (3-0) f s

3 (3-0) f or s

3 (3-0) s

3(3-0) f s

3 (2-2) f s

3 (3-0) f s

EC 401, 402 Principles of Accounting 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** Prerequisite: EC 201 or EC 205

goods and income and determines rate of growth.

EC 205 The Economic Process

EC 301 Production and Prices

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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.

An analysis of the process and principles by which an economy allocates resources, distributes

EC 302 National Income and Economic Welfare

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 310 Economics of the Firm

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

A study of accounting principles from the management point of view; the analysis, recording and interpretation of business data; preparation of financial statesments, their use and interpretation.

EC 315 Salesmanship

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.

2 (2-0) f s

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

Prerequisite: EC 312

An introduction to accounting for manufacturing, fabrication and construction-type enterprises. The determination and allocation of costs of materials, labor, and overhead. Special emphasis is placed on managerial analysis, interpretation, and control of cost data.

EC 410 Industry Studies

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.

3 (3-0) f s

3 (3-0) f

EC 411 Marketing Methods

Prerequisite: EC 201 or EC 205

Marketing institutions and their functions and agencies; retailing; market analysis; problems in marketing.

EC 413 Competition, Monopoly, and Public Policy 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 anti-trust laws.

EC 414 Tax Accounting

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 420 Corporation Finance

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

Prerequisite: Junior standing

Principles and techniques of modern scientific management; relation of finance, marketing, industrial relations, accounting, and statistics to production planning and control; analysis of economic, political and social influences on production.

EC 426 Personnel Management

Prerequisite: Junior standing

The scientific management of manpower, from the viewpoint of the supervisor and the personnel specialists. 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

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.

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3 (3-0) f s

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EC 432 Industrial Relations

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

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 obtained 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**

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.

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A survey of the theories and practices of governmental taxing, spending, and borrowing, including intergovernmental relationships and administrative practices and problems.

EC 446 Economic Forecasting

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

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 Economics Decision Processes

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 490 Senior Seminar in Economics

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

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

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 510 (PS 510) Public Finance Prerequisite: EC 201 or EC 205

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EC 525 Management Policy and Decision Making

Prerequisites: Nine 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

Prerequisites: Senior standing and consent of 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.

Origins of the United States' Economy EC 541

Prerequisites: Senior or Graduate standing; EC 205, HI 261, or HI 333, or equivalents A seminar on growth and development of American economic institutions. Emphasis is placed on the relationship between the growth of the economy of the United States and theories of economic development.

3 (3-0) f

3 (3-0) s

3 (3-0) f

EC 550 Mathematical Models in Economics

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

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

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

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

Prerequisite: EC 501 or equivalent

A rigorous examination of contemporary microeconomic theory.

EC 602 (AGC 602) Monetary and Employment Theory

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

Prerequisites: EC 442 or EC 501, 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.

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) for s

3 (3-0) f or s

3 (3-0) f

EC 605 Research in Economics

Prerequisite: Graduate standing

Individual research in economics, under staff supervision and direction.

EC 640 Theory of Economic Growth

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

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 theoreticallyoriented consideration of policy.

3 (3-0) f s

Credits by arrangement

3 (3-0) f s

Economic Decision Theory EC 650

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**

Prerequisites: EC 501 or equivalent, EC 550 or EC 555

A seminar and research course devoted to recent literature and developments in mathematical economics.

Economic Behavior of the Organization EC 665

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 (General Courses)

Courses for Undergraduates

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 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

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

3 (3-0) f or s

3 (3-0) f s

3 (3-0) s

3 (2-2) s

Summer session only

EDUCATION 273

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	ge classroom. Opportunity for individual work
with an exceptional child will be provided.	Mr. Corter

ED 502 Analysis of Reading Abilities

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

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 501 Education of Exceptional Children Discussion of principles and techniques of teaching the exceptional child with major interest

3 (2-2) f

3 (3-0) f

3 (3-0) s

^{*} The departmental course descriptions in the School of Education follow the general courses.

ED 563 Effective Teaching

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.

Mr. Scarborough

Courses for Graduates Only

ED 614 Modern Principles and Practices in Secondary Education

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

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.

Mr. Chansky

3 (3-0) f s

ED 665 Supervising Student Teaching 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

Agricultural Education

Courses for Undergraduates

ED 102 Objectives in Agricultural Education

Designed to help the student understand the purpose of Agricultural Education at State College. Also provides an opportunity for students to develop an understanding of purposes of vocational agriculture in the school community. Staff

3 (3-0) f s

2 (2-0) f s

3 (3-0) f

ED 201 Farming Programs and FFA

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 313 Teaching Rural People

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.

ED 411 Student Teaching in Agriculture

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.

6 (3-12) f

Staff

2 (2-0) s

1 (1-0) f

2 (2-0) s

ED 412 Teaching Adults 2 (1-2) F Principles of effective teaching applied to adult and young farmers. Experience in organizing and conducting groups for discussion of local problems. Staff

ED 413 Teaching Materials

Developing and using teaching materials for more effective instruction. Experience in this area with adult and high school classes. Staff

ED 430 Senior Seminar

An analysis on the job of the teacher of vocational agriculture with particular emphasis upon current problems.

Courses for Graduates and Advanced Undergraduates

ED 554 Planning Programs in Agricultural Education

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. Beam, Scarborough

Maximum 6 credits

ED 558 Special Problems in Teaching

Prerequisite: ED 411

Current problems in agricultural education. Opportunities for students to study particular Graduate Staff problems under the guidance of the staff.

ED 568 Adult Education in Agriculture

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

Courses for Graduates Only

1 (1-0) f s

2 (1-2) f

3 (3-0) f s

3 (3-0) f s

ED 616 Advanced Problems in Teaching

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

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 Graduate Staff education.

Research in Agricultural Education Maximum 6 credits ED 621 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

3 (3-0) f s

3 (3-0) f s

ED 664 Supervision in Agricultural Education

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.

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.

IA 103 Drafting I

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 Mr. Troxler portion of the course is devoted to instrument drawing.

IA 104 Drafting II

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

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 Mr. Briley of experiences.

IA 108 Woods II

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 Mr. Briley with hand and power tools.

3 (1-4) f

3 (1-4) s

3 (1-4) s

3 (1-4) f

Staff

3 (3-0) f s

IA 203 Technical Sketching

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

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 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 Mr. Moeller experience.

3 (1-4) f

2 (1-2) s

2 (1-2) f

INDUSTRIAL ARTS 277

IA 207 Metal Processing II

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

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

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

This course is an introduction to the basic printing areas of letterpress, offset, photo-printing, silkscreen, and bookbinding. Students will be given the opportunity to develop materials for course outlines which may be used when teaching in the secondary schools.

Mr. Briley

3 (1-4) f

IA 307 Basic Electricity

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

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

2 (1-2) s

Recreational Arts and Crafts IA 314

Required of juniors in Industrial and Rural Recreation; elective for others A course designed to give students interested in recreation 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. Mr. Briley

3 (1-4) s

3 (1-4) s

3 (1-4) s

1 (0-2) f

2 (1-2) s

IA 315 General Ceramics

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

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

ED 422 Methods of Teaching Industrial Subjects

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

3 (1-4) f s

2 (1-2) f s

4(4-0) s

ED 444 Student Teaching in Industrial Subjects

Prerequisite: ED 422

Students in the Industrial Arts and Industrial Education curricula will devote ten weeks during the fall semester to full time, off-campus student teaching in selected public schools throughout the State. They will be assigned to their teaching center in the preceding spring and will report to their supervising teachers when the public schools (to which they are assigned) open in the fall. During the remainder of the term, additional courses will be taken in concentrated form. Staff

IA 465 Independent Study in Industrial Arts

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

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

ED 482 Curriculum Problems in Industrial Arts

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 Staff learning units in industrial arts.

Instructional Aids and Devices ED 483

Prerequisites: PSY 304 or six credits in Education

Analysis of learning units and the preparation of instructional aids and devices.

IA 484 School Shop Planning and Equipment Selection

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

3(3-0) fs

6 (2-15) f

2 (1-2) f

6 f

Staff

2 (1-2) f

3 (3-0) s

Courses for Graduates and Advanced Undergraduates

3 (1-4) IA 510 Design for Industrial Arts Teachers Prerequisites: Six 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

3 or 3

ED 552 Industrial Arts in the Elementary School

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 class-Mr. Hostetler room equipment.

IA 560 (ED 560) New Developments in Industrial Arts Education.

Prerequisites: Twelve hours in Education and teaching experience

This course is a study of the new developments in industrial arts education. It is designed to assist teachers and administrators in developing new concepts and new content based on the changes in technology. They will be required to re-evaluate their programs in the Mr. Hostetler light of these new concepts and the new content.

3 (Summer session)

Required of all graduate students in Industrial Arts Education. Current and historical developments in industrial arts; philosophical concepts, function, scope, criteria for the selection

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. Graduate Staff

IA 575 Special Problems in Industrial Arts

Prerequisite: One term of student teaching or equivalent

The puropse of these courses is to broaden the subject matter experiences in the areas of industrial arts. Problems involving experimentation, investigation and research in one or more industrial arts areas will be required. Graduate Staff

IA 595 (ED 595) Industrial Arts Workshop

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 programs.

Graduate Staff

Courses for Graduates Only

ED 619 Seminar in Industrial Arts Education

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

Research in Industrial Arts Education ED 624

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 630 Philosophy of Industrial Arts

Prerequisite: Twelve hours in Education

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INDUSTRIAL EDUCATION 279

A maximum of 6 credits

A maximum of 6 credits

3 (Summer session)

1(1-0) f s

Maximum 6 credits f s

and evaluation of learning experiences, laboratory organization, student personnel programs, community relationships, teacher qualifications, and problems confronting the industrial arts profession. Mr. Hostetler

ED 635 Administration and Supervision of Industrial Arts 2 (2-0) f s Prerequisite: Twelve hours in Education A study of the problems and techniques of administration and supervision in the improvement of industrial arts in the public schools. Selection of teachers and their improvements

in service and methods of evaluating industrial arts programs. Mr. Hostetler

Industrial Education

Courses for Undergraduates

Introduction to Industrial Education ED 100 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. Mr. Gehres

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ED 305 Analysis of Technical Education Programs and Course Construction 3 (3-0) s Prerequisites: ED 100 and advanced undergraduate standing

Principles and Techniques of selecting and analyzing suitable teaching activities and arranging such material into a functional instructional order. Instructional units prepared will be based on an analysis of a technical occupation or activity. A detailed course of study will be prepared. Mr. Gehres

ED 327 History and Philosophy of Industrial-Technical Education 3 (3-0) f Prerequisite: ED 100

Historical study of trade and technical education movement. Place function and changing concepts of industrial and technical education in American education. Economic, sociological and psychological aspects. Mr. Hanson

ED 405 Industrial and Technical Education Shop and Laboratory Planning 3 (3-0) f Prerequisites: Senior standing and 6 hours of drawing or design

Principles and techniques to assist teachers in planning and organizing shop and laboratory facilities. Problems of locating and equipping vocational schools; the planning and layout of shops and related technology laboratories and classrooms. Individual and group assignments on planning and layout of post secondary school buildings. Mr. Gehres

ED 422 Methods of Teaching Industrial Subjects

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 observation in the public schools.

Staff

ED 440 Vocational Education

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

Prerequisite: ED 422

Student 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.

6 (2-15) f

2 (2-0) f

4 (4-0) s

ED 483 Instructional Aids and Devices

(See page 278 for description)

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Courses for Graduates and Advanced Undergraduates

ED 516 Community Occupational Surveys2 (2-0) sPrerequisites: Six credits in Education and consent of instructor.2 (2-0) s

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 Materials3 (3-0) f sPrerequisite: ED 422

The principles of selecting and organizing both technical and general related instructional material for trade extension and industrial cooperative training classes.

Graduate Staff

k : 30

2 (1-2) f

ED 525 Trade Analysis and Course Construction

Prerequisites: ED 344, PSY 304

Principles and practices in analyzing occupations for the purpose of determining teaching content. Practice in the principles underlying industrial course organization based on occupational analysis covering instruction in skills and technology and including course outlines, job sequences, the development of industrial materials and instructional schedules.

Graduate Staff

ED 527 Philosophy of Industrial and Technical Education 3 (3-0) f s Prerequisites: ED 422, 440

A presentation of the historical development of industrial and technical education; the types of programs, philosophy, trends and problems of vocational-industrial education; study of Federal and State legislation pertaining to industrial education, practical nurse education and technical education. Mr. Hanson

ED 528 Principles and Practices in Industrial Cooperative Training 3 (3-0) f s Prerequisites: ED 422, 440

A study of the developments, the objectives, and principles of industrial cooperative training. The organization, promotion and management of programs in this area of vocational education. Graduate Staff

ED 529 Curriculum Materials Development

Prerequisite: ED 525

Selection and organization of curricula used in vocational-industrial and technical education; development of curricula and instructional materials. Mr. Hanson

ED 591 Special Problems in Industrial Education

Prerequisites: Six hours of graduate credit and permission of department head Directed study to provide individualized study and analysis in specialized areas of trade, industrial or technical subjects. Graduate Staff

Courses for Graduates Only

ED 609 Planning and Organizing Technical Education Programs

Prerequisites: PSY 304, ED 344, 420, 440, and 516

Principles of planning and organizing technical education programs sponsored by federal vocational acts. Professional course for coordinators and directors, with emphasis on the organization of post high school technical education level. Survey of needs, building plans, equipping and maintenance of buildings, financial structure, and personnel organization and management. Mr. Hanson

3 (3-0) s

Maximum 6

3 (3-0) f

3 (3-0) f

ED 610 Administration and Supervision of Vocational Education 3 (3-0) s Prerequisites: PSY 304, ED 344, 420, 440 or equivalent Administrative and supervisory problems of vocational education; practices and policies of Federal and State offices; organization and administration of city and consolidated systems. Mr. Hanson

ED 626 Seminar in Industrial Education

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

Research in Industrial Education ED 627

Prerequisites: Eighteen credits in Education and permission of instructor The student will be guided in the selection of one or more research problems and in the organization of the problems, methods of gathering data, procedure for analyzing data, and best practice for interpreting and reporting data. Graduate Staff

Maximum 2

Maximum 6

Mathematics and Science Education

Courses for Undergraduates

2 (2-0) s Introduction to Teaching Mathematics and Science ED 203 A course designed to aid prospective teachers in becoming familiar with the scope and purposes of secondary education, the qualification and responsibilities of teachers, the relation of the school to the community, and current problems of secondary school teachers.

Mr. Speece

ED 470 Methods of Teaching Mathematics

A study of the purposes, methods, materials, curricula and evaluation practices appropriate Mr. Speece for teachers of mathematics at the secondary level.

ED 471 Student Teaching in Mathematics

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 10 weeks 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

Developing and Selecting Teaching Materials in Mathematics 2 (2-0) f s ED 472 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

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

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 10 weeks 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

3 (3-0) f s

3 (3-0) f

6 (2-15) f s

6 (2-15) f s

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 effectiveness of the content and instruction in high school science courses. Mr. Shannon

Occupational Information and Guidance

Course for Undergraduates

Principles of Guidance ED 420

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 Mr. Morehead principles and procedures.

2 (2-0) f s

Courses for Graduates and Advanced Undergraduates

ED 520 Personnel and Guidance Services

Prerequisites: Graduate standing and 6 hours of Education or Psychology An introduction to the philosophies, theories, principles and practices of guidance and personnel services. Mr. Morehead

ED 524 Occupational Information

Prerequisites: Six 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.

ED 530 Group Guidance

Prerequisites: Six 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

3 (3-0)

ED 533 Organization and Administration of Guidance Services

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 evaluation of guidance services will be considered. Mr. Morehead

ED 590 Individual Problems in Guidance

Prerequisite: Six 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

A maximum of 6 credits

3 (3-0)

3 (0-3)

3 (3-0)

Courses for Graduates Only

ED 631 Educational and Vocational Guidance

3 (3-0) f

Prerequisites: Nine 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

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ED 633 Techniques in Guidance and Personnel

Prerequisites: Nine 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 641 Field Work in Occupational Information and Guidance

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

Research in Occupational Information and Guidance ED 651 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

Psychology

Courses for Undergraduates

PSY 200 Introduction to Psychology

A study of the general characteristics of human behavior, including motivation, learning, development, emotion, thinking, perception and sensation, and measurement. The objectives are development of the ability to communicate in oral and written form accurately and scientifically about behavior; development of an understanding of a capacity to use scientific ideas and processes as they apply to behavior; an understanding of the behavior of organisms. Staff

Experimental Analysis of Behavior PSY 201

Prerequisite: PSY 200

The objectives of this course are to promote the learning of facts and principles derived from an experimental analysis of behavior; to promote familiarity with laboratory operations used in studying behavior; to foster capability to write and speak effectively about behavior. Topics covered include: acquisition, extinction, spontaneous recovery, generalization, differ-Messrs. Barkley, Cook, Newman entiation, secondary reinforcement, chaining.

3 (2-3) f s

2 to 6 f s

3(3-0) f s

3 (3-0) s

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

Prerequisite: PSY 200

A study of learning and evaluation in the context of educational practice.

Mr. Johnson

PSY 337 Industrial Psychology I 3 (3-0) f s Prerequisite: PSY 200 The application of psychological principles to the problems of industry and business; work methods, fatigue, motivation and morale, job analysis, performance measurement. Mr. Drewes

3 (3-0) f s

Courses for Advanced Undergraduates

PSY 438 Industrial Psychology II

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

Human Factors in Equipment Design PSY 441

Prerequisite: PSY 200, PSY 337 recommended

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, Drewes

PSY 464 Visual Perception for Designers

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 perceive visual form.

Mr. Cook

3 (3-0) s

PSY 475 Child Psychology

Prerequisite: PSY 200 or PSY 304

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 Prerequisite: PSY 200

Nature and source of the problems of adolescents in western culture; emotional, social, intel-Messrs. Barkley, Johnson lectual and personality development of adolescents.

PSY 490 Social Psychology

Prerequisite: PSY 200

The individual in relation to social factors. Socialization, personality development, communication, social conflict and social change. Messrs. Barkley, Miller

2(2-0) f s

3 (3-0) s

3 (3-0) f

3 (3-0) s

3 (3-0) s

Courses for Advanced Undergraduates and Graduates

PSY 501 **Experimental Psychology** Prerequisite: Nine hours of Psychology Experimental study of problems in general and theoretical psychology with particular emphasis on sensation and perception. Particular attention is paid to problem formulation, experimental design and experimental method. Effective written and oral performance by the Messrs. Barkley, Cook, Newman student is a basic objective.

PSY 502 Physiological Psychology Prerequisites: Twelve 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, emotions, and motivation. Mr. Bernard

PSY 504 Advanced Educational Psychology 3 (3-0) s Prerequisite: Six hours in Psychology A critical appraisal of current psychological findings that are relevant to educational practice and theory. Mr. Johnson

3 (2-3) f s

3 (3-0) f
3 (3-0) f

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A survey of modern theories of personality with some emphasis on intelligence and cognitive Mr. Corter factors.

THE GENERAL CATALOG 286

PSY 511 Advanced Social Psychology

Prerequisites: PSY 200 and 514, 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 Mr. Miller research studies, and individual projects.

PSY 514 Psychological Research Design

Prerequisite: Graduate standing in Psychology The objectives of this course are to acquaint students with current developments in theory and research in several areas of psychological interest; to foster capability to derive experimentally testable hypotheses, and experimental tests of these hypotheses; to write and speak effectively about theory and experimentation in psychology. Graduate Staff

PSY 530 Abnormal Psychology

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

Prerequisite: Six hours in Psychology

A study of standard tests with an emphasis on the efficient selection and use of such instru-Mr. Johnson ments.

PSY 550 Mental Hygiene in Teaching

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

Industrial Management Psychology PSY 565

Prerequisite: Nine hours of Psychology

A study of the application of behavioral science, particularly psychology and social psychology Mr. Miller to organizational and management problems.

PSY 570 Theories of Personality

Prerequisite: Nine hours of Psychology

3 (3-0) f s

3 (3-0) s

3 (3-0) f

3 (3-0) f s

1 (1-0) f

3 (3-0) f

Individual Intelligence Measurement PSY 571

Prerequisite: PSY 570

A practicum in individual intelligence testing with emphasis on the Wechsler-Bellevue, Stanford-Mr. Corter Binet, report writing, and case studies.

PSY 576 Developmental Psychology

Prerequisite: Nine hours in Psychology, including PSY 476 or PSY 475

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A survey of the role of growth and development in human behavior; particularly of the childhood 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

Prerequisite: Six hours in Psychology

Nature, extent, and practical implications of individual differences and individual variation. Mr. Barkley

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3 (3-0) s

3 (3-0) f

Courses for Graduates Only

PSY 604 Advanced Experimental Psychology: Learning and Motivation 3 (2-3) f or s Prerequisite: PSY 501 or equivalent

The objectives of this course are to promote familiarity with the kinds of research currently being conducted within the areas of "learning and motivation;" to foster effective performance in writing, speaking and reading in this area, in the derivation of hypotheses capable of experimental test and in the design of experiments to test them.

Messrs. Cook, Newman

PSY 606 Behavior Theory

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

Advanced Industrial Psychology | PSY 607

Prerequisites: Nine hours of Psychology and Statistics or concurrent with Statistics Application of scientific methods to the measurement and understanding of industrial behavior. Messrs. Drewes, Miller

Advanced Industrial Psychology II PSY 608

Prerequisite: PSY 607

Application of scientific methods to the measurement and understanding of industrial behavior. Messrs, Drewes, Miller

Psychological Clinic Practicum PSY 609

Prerequisite: Eight hours in Psychology

Clinical participation in interviewing, counseling, psychotherapy and administration of psychological tests. Practicum to be concerned with adults and children. Mr. Corter

PSY 610 Theories of Learning

Prerequisite: PSY 604

The objectives of this course are to promote learning of the theories currently used to explain how learning and forgetting occur so that testable consequences of these theories can be derived and so that the theories and their testable consequences are capably written and spoken about. Messrs. Johnson, Newman

3 (3-0) f

3 (3-0) s

3 (3-0) s

Maximum 9 hours f s

3 (3-0) :

Scientific articles, analysis of experimental designs in industrial psychology, and study of special problems of interest to graduate students in Industrial Psychology. Graduate Staff

Credits by arrangement PSY 613 Research in Psychology Individual or group research problems; a maximum of six credits is allowed toward the master's degree. Graduate Staff

PSY 635 **Psychological Measurement**

Prerequisites: ST 511 or equivalent and 12 hours of Psychology Theory of psychological measurement. Statistical problems and techniques in test construction. Mr. Drewes

Personality Measurement PSY 672

Prerequisites: PSY 570, PSY 571 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

3 (2-3) f s

PSY 612 Seminar in Industrial Psychology

3 (3-0) f s

3 (3-0) s

Recreation and Park Administration

Courses for Undergraduates

RPA 152 Introduction to Recreation

This course is designed to provide instruction in the areas of 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

RPA 153 The Aquatic Program

Prerequisite: PE (swimming)

This is a laboratory course including 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

RPA 201 **Playground Leadership**

Prerequisite: RPA 152

Emphasis is placed on the principles, techniques, and activities necessary for effective playground leadership. Special emphasis is given through the following practical laboratory experiences: activities of low organization; contests; relays; acquatic activities; table games; and Mr. Miller elementary arts and crafts.

RPA 207 History and Principles of Park Administration

Prerequisite: RPA 152

This course includes the study of the history, present status and the basic principles of Mr. Miller operation of parks and park systems in America.

Principles of Physical Education RPA 253

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.

Mr. Brantley

3(3-0) f s

3 (2-3) f s

2(2-0) f s

3(3-0) fs

2(0-4) f s

RPA 255 Social Recreation

Prerequisite: Sophomore status

This course is designed to satisfy the needs of the recreator for conducting social play. 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

Organization and Administration of Physical Education 3 (3-0) f s RPA 301 Prerequisite: RPA 253

This course is designed to prepare students to meet the problems of organization and administration of physical education. It presents the solution to many of the problems facing the administrator and teacher in organizing and administering a physical education program with analogies of these problems to other areas in the field of recreation.

Mr. Brantley

2 (2-0) f s

RPA 315 Prevention and Care of Athletic Injuries

Prerequisite: ZO 213

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

4 (2-4) f s

RPA 333 First Aid and Safety

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. Crawford

3 (2-2) f s

2(1-2) f s

RPA 335 **Camping and Outdoor Education**

Prerequisite: Junior status

This course covers the history of school camping and outdoor education. The scope of this course is to provide the student with a background of principles, organization and administrative techniques, and camping skills to be utilized in a school operated program.

Mr. Stott

RPA 353 Camp Organization and Leadership

Prerequisites: RPA 153 and RPA 201

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

Personal and Community Hygiene RPA 354

Prerequisite: Junior status

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 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. Brantley

RPA 355 Sports in Recreation

Prerequisite: RPA 152

This course provides for group instruction and laboratory experience in a variety of sports applicable to a recreation setting. Emphasis is given to problems involved in the organization and administration of a community sports program. Officiating techniques applicable to recreation sports are utilized. Mr. Brantley

RPA 360 Individual Corrective and Adapted Activities Prerequisites: ZO 212, 213

This course provides students with: methods to motivate the atypical individual to 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. Mr. Crawford

4 (2-4) f s

3 (3-0) f s

3 (3-0) f s

3 (2-2) f s

Methods and Materials in Health and Physical Education **RPA 365** 3 (3-0) f s Prerequisite: RPA 301 This course presents to the prospective physical activity instructor methods and materials of instruction; also the course provides study in the areas of healthful school living, health service, and health instruction. Mr. Brantley

Courses for Advanced Undergraduates

RPA 405 Principles and Practices of Recreation 3 (3-0) f s Prerequisite: RPA 415 A study of existing practices of recreation, their operation, methods of finance, scope, and problems are emphasized. The inter-relationship and inter-dependence of all forms of organized recreation are stressed. Mr. Hines

RPA 415 Park Maintenance and Operation

Prerequisite: RPA 152

This course deals with methods of operation of various park facilities for public use; interpretive and public use programs; information and education; park personnel administration; protection and law enforcement; preventive maintenance; job planning and scheduling; modern maintenance techniques and maintenance materials. Mr. Stott

RPA 451 Facility and Site Planning

Prerequisite: RPA 415

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

RPA 452 Recreation Administration

Prerequisite: RPA 470

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

6 (9 weeks) Summer

RPA 470 Supervised Practice

Prerequisites: RPA 353, 355

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 prior to his senior year will spend 9 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.

RPA 471 Organizing the Recreation Program

Prerequisite: RPA 470

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. Miller

3 (3-0) f s

3 (0-6) f s

3 (3-0) f s

RPA 472 Observation and Field Experience

Prerequisite: RPA 470

This course is designed to provide the student with the opportunity to observe, appraise and evaluate: the operation of program activities; teaching methods; administrative, supervisory and organizational techniques; procedures and conduct of advisory and commission meetings; professional conferences and society meetings. Students will be expected to complete this entire gamut. By use of field experience the student will be expected to prepare written reports of observations. Only those experiences approved by the recreation faculty shall be Mr. Miller

Courses for Graduates and Advanced Undergraduates

RPA 501 Special Problems in Recreation

Prerequisite: RPA 470 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.

3 (2-2) f s

Mr. Hines

Electrical Engineering

Courses for Undergraduates

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EE 201 **Elementary Circuits and Fields**

Corequisite: MA 201 Required of sophomores in Electrical Engineering Fundamental laws of electric circuits. Introduction to transient and steady-state analysis. Problem drill and laboratory exercises. Staff

EE 202 **Elementary Circuits and Fields**

Prerequisites: EE 201, MA 201

Required of sophomores in Electrical Engineering

A continuation of EE 201. Introduction to magnetic circuits, magnetic and electric fields, energy conversion and two-port active elements. Problem drill and laboratory exercises.

EE 301, 302 Intermediate Circuits and Fields

Prerequisites: EE 202, PY 202, and MA 202

Required of juniors in Electrical Engineering

An intermediate treatment of lumped-constant alternating-current circuits in the steady state. Single-and three-phase circuits. Discussion of electric and magnetic fields, distributed constants, and traveling waves. The theory of transmission lines at power and audio frequencies. Filters and impedance matching. One three-hour laboratory per week is included in the first semester. Staff

EE 305 Electrical Machinery

Prerequisite: EE 202

Required of juniors in Electrical Engineering

A classroom and laboratory study of the principles, performance, and characteristics of direct-current and alternating-current machinery. Staff

EE 306 Electrical Machinery

Prerequisites: EE 301 and EE 305

A continuation of EE 305 into more advanced phases of the theory of alternating- and directcurrent machinery. Staff

EE 310 Illumination

Prerequisite: EE 301 or EE 320 or EE 331

A study of the principles involved in the production and utilization of light from artificial

4 (2-5) f 3 (2-2) s

Staff

4 (2-5) f s

4 (2-5) s

4 (2-5) f

4 (3-3) s

3 (2-3) s

sources; of the requirements for good lighting; and of the design of lighting installations for schools and industry. Mr. Winkler

EE 314 Electronics

Prerequisite: EE 301

A study of active vacuum, gas, and solid state devices as elements of electric circuits. Analysis is made of linear and non-linear representation and operation. Mr. Manning

EE 320 Elements of Electrical Engineering 4 (3-3) f s Prerequisites: MA 202 and PY 202 Required of seniors in MEA, AGE, MIC, CHE, MIG, CE Principles, characteristics, and operation of electric equipment and systems. Theory and

problems in applied electricity, motor characteristics, industrial applications, and electronics. Mr. Smiley

EE 331, 332 Principles of Electrical Engineering 4 (3-3) f s Prerequisites: MA 202 and PY 202 Required of seniors in Industrial Engineering and Mechanical Engineering Basic concepts, electrical power generation and utilization, circuit elements, single and poly-

phase a.c. circuits, transformers, rotating electrical machines. Fundamentals of electronics and control circuits. Staff

4 (2-5)

3 (2-3) s EE 350 Electric Power Utilization in Manufacturing Processes Prerequisite: PY 212

Introduction to basic electrical theory; d-c and a-c circuits and measurements; study of d-c motors and of single-phase and polyphase utilization equipment; basic control systems and brief introduction to principles of automatic control. Application examples will be drawn from the technologies of particular interest to the students in the class. Mr. Smiley

Courses for Advanced Undergraduates

EE 401 Advanced Circuits and Fields A

Prerequisites: EE 302, MA 301

Required of seniors in Electrical Engineering

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.

EE 402 Advanced Circuits and Fields B

Prerequisites: EE 302 and MA 301

Required of seniors in Electrical Engineering

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 Staff waves.

EE 411 **Electrical Engineering Senior Seminar**

Prerequisite: Senior standing

Required of seniors in Electrical Engineering

Weekly meetings for the delivery and discussion of student papers on topics of current in-Staff interest in Electrical Engineering.

EE 430 Essentials of Electrical Engineering

Prerequisite: EE 301 or 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 engi-Staff neering undergraduate degree.

EE 431 Electronic Engineering Prerequisites: EE 302, EE 314

3 (2-3) f

3 (2-2) s

Staff

1 (0-2) f

4 (3-3)

3 (2-2) f

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 432 Communication Engineering

Prerequisite: EE 431

Departmental elective for seniors in Electrical Engineering

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

Electric Power Engineering EE 433

Prerequisites: EE 302 and EE 305

Departmental elective for seniors in Electrical Engineering

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

3 (2-3) f

3 (2-3) s

EE 434 Power System Analysis

Prerequisites: EE 302 and EE 305

Departmental elective for seniors in Electrical Engineering

Analysis of problems encountered in the long-distance transmission of electric power. Line parameters of the method of geometric mean distances. Circle diagrams, symmetrical components, and fault calculations. Elementary concepts of power system stability. Applications of digital computers to power-system problems. Mr. Stevenson

EE 435 Elements of Control

Prerequisites: EE 314 and EE 305; or EE 430

Departmental elective for seniors in Electrical Engineering

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 438Instrumentation in Nuclear Technology3 (2-3) sPrerequisites: Either EE 430 or EE 301, EE 305 and EE 314; also MA 301Required course in Nuclear Engineering, Instrumentation Option curriculumRadiation detectors, pulse amplifiers, pulse shapers, amplitude discriminators, counters, co-incidence circuits.Mr. Manning

EE 440 Fundamentals of Digital Systems

Prerequisites: EE 314 or EE 430

Departmental elective for seniors in Electrical Engineering

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 and Advanced Undergraduates

EE 503 Linear Network Theory

Prerequisites: Senior standing in Électrical Engineering with "B" average in Electrical Engineering and Mathematics or EE 430

Analysis of linear networks with emphasis on the system functions of the network in the frequency domain and response in the time domain.

EE 506 Dynamical Analogies

3 (3-0) s

Prerequisites: EE 301 or EE 331; EM 312 or EM 301; MA 301; "B" average in Electrical En-

3 (2-3) s

3 (2-3) f

3 (3-0) s

3 (3-0) f

gineering, Engineering Mechanics, and Mathematics

A study of dynamic systems in various branches of engineering and science with emphasis on the similarities that exist among such integrated groups of devices. Analogous elements and quantities in these fields as determined from equations basic to each. Analytical formulation of system problems in acoustical, electrical, mechanical, and related fields and their solution by analog methods. Use of electronic analog computers for the solution of system problems. Mr. Eckels

EE 507 Electromagnetics

Prerequisites: Senior standing in Electrical Engineering with "B" average in Electrical Engineering and Mathematics or EE 430 Basic principles of electromagnetic field theory in vector analysis formulation, including static electric and magnetic fields, Maxwell's equations and applications to guided waves.

EE 512 Communication Theory

Prerequisites: EE 431, "B" average in Electrical Engineering and Mathematics The frequency and time domain, modulation, random signal theory, autocorrelation, basic information theory, noise, communication systems. Mr. Barclay

3 (2-3) s

3 (3-0) f

EE 516 Feedback Control Systems

Prerequisites: EE 401 and EE 435

Departmental elective for seniors in Electrical Engineering

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 and compensation and introduction to design.

EE 517 Control Laboratory

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 520 Fundamentals of Logic Systems

Prerequisite: EE 314 or EE 430

Boolean algebra, logic circuits, systematic minimization, block diagrams, logic systems in computers, diode and transistor logic, pulse operation, counters, multivibrators, cascaded systems, sequential systems. Mr. Bell

Courses for Graduates Only

EE 605, 606 Electrical Engineering Seminar

Prerequisite: Graduate standing in Electrical Engineering

A series of papers and conferences participated in by the instructional staff, invited guests, and students who are candidates for advanced degrees. Mr. Eckels

EE 611, 612 Electric Network Synthesis

Prerequisite: EE 501

A study of modern network theory, with the emphasis on synthesis, based on the work of Brune, Bode, Guillemin Bott and Duffin, Foster and many others. Both the realization problem and the approximation problem will be treated. Mr. Hoadley

EE 613 Advanced Feedback Control

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.

3 (3-0) s

3 (3-0) s

1 (0-3) s

1 (1-0) f s

3 (3-0) f s

3 (3-0) s

Mr. Peterson

EE 615 Electromagnetic Waves

Prerequisite: EE 502

Maxwell's equations applied to a study of the propagation of energy by electromagnetic waves. Vector and scaler retarded potentials, propagation in free space and material media, guided electromagnetic waves, common waveguides, skin effects, resonant cavities. Microwave network theory applied to measurement problems. Mr. Schafer

EE 616 Microwave Electronics

Prerequisite: EE 615

Frequency limitations of conventional electron tubes. Microwave power generation and control by interaction of electromagnetic fields with charged particles and molecular energy levels, and by non-linear reactances. Applications in klystrons, magnetrons, traveling-wave tubes, masers, and reactance amplifiers. Measurement problems and techniques in microwave region. Mr. Barclay

4 (3-3) s

4 (3-3) f

EE 643 Advanced Electrical Measurements Prerequisites: EE 501, EE 431

Prerequisite: EE 615

EE 618 Antennas and Propagation

Prerequisites: EE 501 and EE 512

Electromagnetic wave theory applied to antennas and antenna arrays with emphasis on microwave frequencies. Calculation and measurement of directional characteristics, gain, field in tensity, propagation via the ionosphere over various terrains, obstacle gain, gain height theory, forward scatter and other topics. Mr. Schafer

Tube and transistor circuit techniques for the production, shaping, and control of nonsinusoidal wave forms. Fundamental circuits needed in pulse information systems, instrumentation,

EE 621 **Electron Devices**

Prerequisite: EE 615

and computers.

Internal operation of electron tubes and transistors; similarities and differences stressed. Electrical conduction through vacuum and semi-conductors. Space charge, junction and diffusion effects. Characteristics of tubes and semiconductor devices at low frequencies and in various environments, parameters, and equivalent circuits of active devices.

Mr. Schafer

3 (3-0) f

3 (3-0) s

3 (3-0) s

4 (3-3) s

3 (3-0) s

Mr. Barclay

EE 617 Pulse Switching and Timing Circuits

EE 637 Circuit Analysis of Power Systems

Prerequisite: EE 514

An advanced treatment of symmetrical components applied to unsymmetrical systems, and simultaneous faults. Mr. Stevenson

EE 638 Power System Stability

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

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

2 (2-0) s

3 (3-0) s

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

Prerequisites: EE 615 or PY 503; MA 512

A comprehensive study of electromagnetic theory with emphasis on field theory applications. Charges in both uniform and accelerated motion, field equivalence principles, anisopropic media, ferrite media, variational methods for waveguide discontinuities, periodic structures including Floquet's theorem, integral transform and function-theoretical techniques, solid state theory applied to quantum electronic devices. Mr. Schafer

EE 650 Electrical Engineering Research Credits by arrangement Prerequisites: Graduate standing in Electrical Engineering 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

3 (3-0) f s

Engineering

E 100 Introduction to Engineering

Introduces the student to the profession of engineering and the characteristics and requirements of the study of engineering. Mr. Adams

E 500 **Engineering Analysis**

Prerequisites: Senior standing and selection for Honors Programs 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 Honors

Contemporary Trends In Engineering and Science EH 300

Prerequisite: For juniors in the Engineering Honors Program

Representatives from varied fields of engineering and science introduce and discuss topics of current significance in their areas of interest.

EH 344 **Rigid Body Dynamics I**

Prerequisite: For members of the Engineering Honors Program or by permission of the instructor

The study of the concepts and principles relating to the kinematics and kinetics of particles and rigid bodies. Illustration of the consequences and applications of the principles through problems of ballistics, orbital motion, vibrations, etc. The vector treatment is used extensively.

EH 345 Strength of Materials

Prerequisites: EM 311, EM 341. For members of the Engineering Honors Program or by permission of the instructor

Introduction to the behavior of deformable solids. Development of relationships among loads, stresses, strains, and displacements. Mathematical representation and analysis of the behavior of shells, beams, shafts, columns, etc.

EH 346 Fluid Mechanics

Prerequisites: EM 312 or EH 344, MA 301. For members of the Engineering Honors Program or by permission of the instructor

Study of the concepts and principles relating to fluid mechanics. Equilibrium of liquids and gases, kinematics and dynamics of frictionless fluids. Motion of viscous fluids. Dynamics of gases. Flow measurement techniques.

1(1-0) f s

1 (1-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0)

EH 371 Thermodynamics I

Prerequisite: For members of the Engineering Honors Program or by permission of the instructor

A study of the basic principles and concepts of thermodynamics. The First and Second Laws are studied with emphasis on the generality and consequences of the basic laws. The mathematics of property relationships as well as properties of working substances are investigated. Applications of the principles to diverse fields such as elasticity, electromagnetism, propulsion are presented to emphasize generality.

EH 372 Thermodynamics II

3 (3-0) s

Prerequisites: EH 371. For members of the Engineering Honors Program or by permission of the instructor

Thermodynamics of compressible fluid flow, normal shock relations, generalized conservation equations, nozzle flow, one dimensional flows, thermodynamic equilibrium, free energy functions, Gibbs phase rule, and generalized criteria for equilibrium. Thermodynamics of chemically reactive systems, stoichiometry, standard states, heats of reation and formation, equilibrium composition, adiabatic flame temperature, dissociation. Introduction to Statistical Thermodynamics, thermodynamics of electromagnetic fields, thermodynamics of radiation.

3 (3-0) f

3 (3-0) s

EH 401 Special Topics in Engineering Prerequisite: For members of the Engineering Honors Program or by permission of the instructor

Special projects in various phases of engineering.

Engineering Mechanics

Courses for Undergraduates

EM 200 Introduction to Mechanics

Corequisite: MA 301

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An introduction to the principles and concepts which form the basis for studies in dynamics, solid mechanics, and fluid mechanics. The nature and properties of force systems and stress fields. The motion of particles and description of deformation of continuous media. The role of Newton's laws, the concepts of continuity and equilibrium, and the conservational principles in problems in mechanics.

EM 301 Solid Mechanics I

Prerequisite: EM 200

Introduction to the mechanics of deformable solids. Development of the equations which describe the linear elastic solid. Approximate solutions and solutions governed by the theory of elasticity to problems involving prescribed force systems, states of motion, or energy inputs.

EM 302 Solid Mechanics II

Prerequisite: EM 301

Continuation of EM 301. Equations for thin plates. Introduction to the theory of plasticity. Theories of yielding, plastic stress-strain relationships, and two-dimensional problems in plastic behavior.

EM 303 Fluid Mechanics I

Prerequisite: EM 200

Development of the basic equations of fluid mechanics in general and specialized form. Application of these specialized equations to a variety of topics including (1) fluid statics, (2) inviscid, incompressible fluid flow, and (3) viscous, incompressible fluid flow.

EM 304 Fluid Mechanics II

Prerequisite: EM 303

Continuation of EM 303. Further applications of the basic equations of fluid mechanics to (1) boundary layer analysis, (2) laminar and turbulent flows and (3) compressible fluid flow. Introduction to experimental methods in fluid mechanics.

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EM 341 Mechanics A (Statics)

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.

EM 342 Mechanics B (Dynamics)

Prerequisite: EM 341 or EM 200

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.

EM 343 Strength of Materials A

Prerequisite: EM 200 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.

2 (2-0) f s

2 (2-0) f s

2 (2-0) f s

EM 401 **Experimental Mechanics I**

Prerequisites: EM 301, 303

A course in the principal experimental methods employed in the analysis of contemporary problems of engineering in which mechanics dominates. Special emphasis is given to those phenomena which give rise to instruments for measurement of prime mechanical variables. Experimental analysis of mechanical fields and interpretation of date are major topics.

EM 402 **Experimental Mechanics II**

Prerequisite: EM 401

Selected experiments which illustrate basic phenomena of mechanics in engineering systems. A particular emphasis is the experimental synthesis of such systems and the evaluation of their behavior as designed.

EM 430 Fluid Mechanics

Prerequisite: 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 501, 502 Continuum Mechanics I, II

Prerequisites: EM 301; 303; ME 301; MA 405

The concepts of stress and strain are presented in generalized tensor form. Emphasis is placed on the discussion and relative comparison of the analytical models for a series of continua including the linear elastic solid, the perfect fluid and the viscous (Newtonian) fluid. The underlying thermodynamic principles are presented, the associated boundary value problems are formulated and selected examples are used to illustrate the theory.

EM 503 Theory of Linear Elasticity

Prerequisites: EM 301; 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 504 Mechanics of Ideal Fluids

Prerequisite: EM 430 or EM 304; Corequisite: MA 513

Basic equations of ideal fluid flow; potential and stream functions; vortex dynamics; body forces due to flow fields; method of singularities in two-dimensional flows; analytical determination of potential functions; conformal transformations; free-streamline flows.

3(0-6) f s

3 (3-0) f s

3(3-0) f s

3(3-0) f s

2 (2-0) f s

EM 505 Mechanics of Viscous Fluids I

Prerequisite: EM 430 or EM 304; Corequisite MA 532

Equations of motion of a viscous fluid (Navier-Stokes Equations); general properties of the Navier-Stokes equations; some exact solutions of the Navier Stokes equations; boundary layer equations; some approximate methods of solution of the boundary layer equations; laminar boundary layers in axi-symmetric and three-dimensional flows; unsteady laminar boundary layers.

(Offered in fall semester of 1962-63)

EM 506 Mechanics of Compressible Fluid I

Prerequisites: EM 430 or EM 304; ME 302; Corequisite: MA 532

Introduction to compressible fluid flow; isentropic, one-dimensional flow; Rayleigh and Fanno line flows; generalized one-dimensional flow; normal shock waves; introduction of multidimensional, compressible flow.

(Offered in the fall semester of 1963-64)

EM 507 Systems Analysis

Prerequisites: EM 301; 303; MA 511 A course in the design of engineering systems in which mechanics dominates. (Offered in the fall semester of 1963-64)

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3 (3-0) f

3 (3-0) f

EM 508 Systems Synthesis

Prerequisite: EM 507 A course in the design of engineering systems in which mechanics dominates. (Offered in the fall semester of 1963-64)

EM 509 Space Mechanics I

Prerequisites: EM 302; EM 304; Corequisite: MA 511

The application of mechanics to the analysis and design of orbits and trajectories. Trajectory computation and optimization; space maneuvers; re-entry trajectories; interplanetary guidance. (Offered in the fall semester of 1962-63)

EM 510 Space Mechanics II

Prerequisites: EM 509; MA 511

Continuation of EM 509. The analysis and design of guidance systems. Basic sensing devices; the characteristics of an inertial space; the theory of stabilized platforms; terrestrial inertial guidance.

(Offered in the spring semester of 1962-63)

EM 511 Theory of Plates and Shells

Prerequisites: EM 301 accompanied by MA 511

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.

(Offered in the spring semester of 1962-63)

EM 551 Advanced Strength of Materials

Prerequisites: EM 301

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 552 Elastic Stability

Prerequisites: MA 301; MA 405; 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. Optimization applied to problems of aeroelastic and civil engineering structures. (Offered in the fall semester of 1963-64)

3 (3-0) f

3 (3-0) f

3 (3-0) f

3 (3-0) s

3 (3-0) s

3 (3-0) s

EM 555 Dynamics I

Prerequisites: EM 301; MA 405

The theory of vibrations from the Lagrangian formulation of the equations of motion. Free and forced vibrations with and without damping, multiple degrees of freedom, coupled motion, normal mode vibrations, wave propagation in solid bodies. (Offered in the fall semester of 1963-64)

EM 556 Dynamics II

Prerequisites: EM 301; MA 405

The dynamics of particles and rigid bodies by the use of formulations of the laws of mechanics due to Newton, Euler, Lagrange, and Hamilton. Accelerated reference frames, constrains, Euler's angles, the spinning top, the gyroscope, precession, stability, phase space, and nonlinear oscillatory motion.

(Offered in the spring semester of 1963-64)

3 (3-0) f

3 (3-0) s

Courses for Graduates Only

EM 601, 602 Unifying Concepts in Mechanics I, II

Prerequisite: PY 601

Generalized treatment of the fundamental equations and boundary value problems of continuous and non-continuous media. Use is made of contemporary developments in irreversible thermodynamic, statistical mechanics, and electrodynamics to provide a unified foundation for the development of principles governing the dynamics and thermodynamic behavior of elastic, plastic and visco-elastic solids, viscous fluids and rheological media.

(Offered in the fall and spring semesters of 1962-63)

EM 604 Theory of Plasticity

Prerequisite: MA 503

Development of the equations representing the plastic behavior of deformable solids. Yield conditions and plastic stress-strain relations. Plane strain theory, hyperbolic equations and slip line fields. Selected problems to illustrate the theory. (Offered in the spring semester 1963-64)

EM 605 Plastic Limit Analysis

Prerequisite: EM 503 Determination of the load carrying capacity of perfectly plastic structures including frames, plates, and shells. Emphasis on the underlying principles and general methods of analysis for bodies involving three-dimensional states of stress. (Offered in the spring semester of 1962-63)

EM 611 Mechanics of Compressible Fluids II

Prerequisite: EM 506

Continuation of EM 506; linearized theory of two-dimensional, compressible flow; method of characteristics for two-dimensional supersonic flow; oblique shock waves; unsteady one-dimensional flow; shock-wave boundary layer interactions; transonic flow.

(Offered in the spring semester of 1963-64)

EM 612 Mechanics of Vicsous Fluids II

Prerequisite: EM 505

Continuation of EM 505; phenomenological theories of turbulence; turbulent flow in ducts and pipes; turbulent boundary layer with and without pressure gradient; compressible boundary layer with and without pressure gradient; compressible boundary layer; boundary layer control; free viscous flow.

(Offered in the spring semester of 1962-63)

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(Oncied in the spring semester of 1502-05)

EM 695 Experimental Methods in Mechanics

Prerequisite: Consent of instructor

The study of specialized experimental techniques utilized in contemporary research in the areas of Mechanics.

EM 697 Seminars in Mechanics

Prerequisites: Graduate standing and consent of adviser The discussion and development of theory relating to contemporary research in the frontier areas of Mechanics.

EM 698 Special Topics in Mechanics Maximum 9 credits f s The study, by small groups of graduate students under the direction of members of the faculty, of topics of particular interest in various advanced phases of mechanics.

EM 699 Research in Mechanics Individual research in the field of Mechanics. Maximum 6 credits f s

Maximum 3 credits f

Maximum 6 credits s

English

Freshman English

ENG 111 Composition and Rhetoric

Required of all freshmen

Intensive study and practice in the basic forms and principles of expository communication; conferences.

ENG 112 Composition and Reading

Required of all freshmen

Continued practice in expository writing; research paper; introduction to literary types; collateral reading; conferences.

Note: Qualified students will be allowed to register for ENG 112 and will be given credit for both 111 and 112 upon successful completion of the latter. Eligibility for 112 will be based on a predetermined score on the Verbal Aptitude section of the SAT plus a composition to be written at the first or second class meeting of the 112 section.

Writing

ENG 211 **Business Communications**

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.

Principles of News and Article Writing ENG 215

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

Prerequisites: ENG 112 and 215 or equivalent

A continuation of ENG 215, with intensive practice in writing and criticizing non-technical articles.

ENG 222 Advanced Composition (Creative Writing) Prerequisite: ENG 112

3 (3-0) f s

3 (3-0) f s

3 (3-0) s

3 (3-0) f s

3 (3-0) f s

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 mastery 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) f s Prerequisite: ENG 112 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

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

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

Prerequisite: ENG 231 or equivalent

Public speaking for special occasions, including speech of introduction, committee-room speech, after-dinner speech, speech at professional conventions, political speech, formal sales talk.

ENG 334 Oral Reading

Prerequisites: ENG 112 and 231, or approval of the department

Training in the analysis and presentation of printed materials, technical and semi-technical, for platform, radio, and television. Emotional reactions to add color and interest; expressive body and voice; correction of faulty habits.

ENG 336 Parliamentary Practice

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

Prerequisites: ENG 112 and 231, or approval of the department

The theory and practice of leading and taking part in such groups as panels, forums, symposiums, conferences and committees. Oral and written assignments. Frequent recordings.

Literature

3 (3-0) f s

3 (3-0) s

3 (3-0) f

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3 (3-0) f s

3 (3-0) f s

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Note: ENG 112 is prerequisite to all courses in literature.

ENG 205 Reading for Discovery 3 (3-0) f s A study of selected masterworks drawn from American, 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 (1) 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 (11) 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 (1) 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

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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.

Short Prose Fiction ENG 382

The study of selected short stories by the most representative of contemporary British and American writers.

Literature of Scientific Thought ENG 460

Chief documents of scientific thought from Aristotle to the present day with emphasis on literary values.

Major American Writers ENG 468

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 365 and ENG 468.)

ENG 471 The Novel

3 (3-0) f s Intensive analysis of some of the most influential English, American, and Continental novels chosen to illustrate the structure and the development of the form.

ENG 480 Modern Drama

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

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.

Literature of the Non-Western World ENG 497

3 (3-0) s Study of a selected group of translations from the literature of Persia, India, China, and Japan as they reflect cultural backgrounds.

3 (3-0) f

3(3-0) f s

3(3-0) f s

3 (3-0) s

3 (3-0) f

ENG 498 Contemporary Literature

3 (3-0) s A study of selected examples of American, British, and Continental writing from 1890 to the present day with reference to changing literary forms and themes.

ENG 499 Literary Analysis (Senior Seminar)

Prerequisites: ENG 112 and departmental approval A flexible course in reading and criticism designed to synthesize the student's preceding work in literature and to provide a capstone for his undergraduate program.

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. Farrier

3 (3-0) f s

3 (2-2) f or s ENT 312 Introduction to Economic Insects A basic course, covering the fundamentals of insect classification, development, food habits, Mr. Brett and controls.

ENT 322 Beekeeping

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

Prerequisite: ENT 301 or 312

Covers general morphology, external and internal, of the insects and their relatives. ENT 501 will deal primarily with external morphology and ENT 502 with internal morphology. (Will Mr. Young be offered 1963-64 and alternate years.)

ENT 506 Chemistry of Insecticides

Prerequisites: ENT 312, CH 203

A study of the critical chemical, physical, and biological properties of compounds used for insect control. This course is directed toward obtaining fundamental knowledge of the scientific principles underlying modern methods of plant protection including details of actual methods of insecticide application. (Will be offered 1963-64 and alternate years).

Mr. Guthrie

3 (1-4) f

ENT 511 Systematic Enotomology

Prerequisite: ENT 301 or 312

A somewhat detailed survey of the orders and families of insects, designed to acquaint the student with these groups and develop in the student some ability in the use of keys, descriptions, etc. (Will be offered 1963-64 and alternate years.) Mr. Young

ENT 531 Insect Ecology

Prerequisite: ENT 301 or 312 or equivalent

The influence of environmental factors on insect development, distribution, and abundance. Mr. Rabb (Will be offered 1963-64 and alternate years.)

ENT 541 Immature Insects

3 (2-2) s

3 (2-2) f

4 (2-4) f

3 (2-2) s

3 (1-4) f s

Prerequisite: ENT 301 or 312 or equivalent

A study of the characteristics of the immature forms of the orders and principal families of insects. (Will be offered 1962-63 and alternate years.) Messrs. Rabb, Neunzig

ENT 551, 552 Applied Entomology

Prerequisite: ENT 301 or 312

An advanced course in which the principles of applied entomology are studied in respect to the major economic insect pests. Methods of determining and examining insect damage, the economic importance of insects, and the chief economic pests of man, food, and fiber are studied as well as laws and regulations pertaining to insects and insecticides. (Will be offered Mr. Mistric 1962-63 and alternate years.)

ENT 561 Literature and History of Entomology

Prerequisite: ENT 301 or 312 or equivalent

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; taxonomic indexes and literature (with a historical background) and history of the development of zoological science from ancient to modern times with emphasis on entomology. (Will be offered 1963-64 and alternate years.) Mr. Farrier

3 (2-2) f s

3 (3-0) f

ENTOMOLOGY 305

ENT 571 Forest Entomology

Prerequisite: ENT 301 or 312

A study of methods of identification of forest pests, the factors governing their abundance habits, and control. (Will be offered 1963-64 and alternate years.) Mr. Farrier

ENT 582 (ZO 592) Medical and Veterinary Entomology (Parasitology) 3 (2-3) s Prerequisite: ENT 301 or 312 A study of the morphology, biology and control of the parasitic anthropods of man, domestic and wild animals. (Will be offered 1963-64 and alternate years.)

Messrs. Harkema, Farrier

ENT 590 **Special Problems**

Credits by arrangement 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. Graduate Staff

ENT 592 Acarology

Prerequisite: ENT 301 or 312, or ZO 103

A systematic survey of the mites and ticks with emphasis on identification, biology and control of the more common and economic forms attacking material, plants and animals including man. (Will be offered 1962-63 and alternate years.) Mr. Farrier

Courses for Graduates Only

ENT 602 Principles of Taxonomy

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. (Will be offered 1962-63 and alternate years.) Mr. Young

Insect Physiology ENT 611

Prerequisite: ENT 312, ENT 502, CH 451, or equivalent

The course deals with the physiology and biochemistry of insects. The function of the different organ systems and the intermediary metabolism of insects will be considered. Laboratory work will include techniques of current importance in physiological research. (Will be offered 1962-63 and alternate years.) Mr. Hodgson

3 (1-4) s

3 (2-2) s

4 (3-2) f

3 (2-2) f

ENT 622 Insect Toxicology

Prerequisite: ENT 312, CH 426 or equivalent

The course deals with the relationship of chemical structure to toxicity in insects. The biochemical mechanisms involved in toxication and de-toxication will be stressed as well as physiological explanation of the chemical poisoning of insects. The biochemical, behavioral, and morphological explanation of resistance to insecticides will be studied. Laboratory work involves cholinesterase inhibition, dehydrochlorination of DDT by resistant houseflies, comparative toxicity of insecticides, and bioassay methods. (Will be offered 1962-63 and alternate years.) Mr. Guthrie

ENT 680 Seminar 1-1 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

2 (1-2) s ST 302 Machine Techniques for Data Processing The use of conventional IBM punch card machines with special emphasis on the processing Mr. Verlinden of data using a stored program calculator.

ST 311 Introduction to Statistics

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, elemen-Messrs. McVay, Monroe tary and basic statistical techniques.

ST 361 Introduction to Statistics for Engineers I

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.

Messrs. Hader, Grandage

ST 362 Introduction to Statistics for Engineers II

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; chi-square tests; sampling acceptance inspection; introduction to analysis of vari-Messrs. Hader, Grandage ance and design of experiments.

ST 421, 422 Introduction to Mathematical Statistics

Prerequisite: MA 212

Elementary mathematical statistics primarily for students not intending to take further work in theoretical statistics. Includes introduction to probability, common theoretical distributions, moments, moment generating functions, sampling distributions, (F, t, chi-square), elementary estimation and hypothesis testing concepts, bivariate distributions, simple and multiple linear regression, analysis of variance, and elementary design of experiments. Staff

2011/2012

3 (2-2) s

3 (3-0) f s

3 (3-0) f s

3 (2-2) f s

3 (3-0) f s

Courses for Graduates and Advanced Undergraduates

3 (3-0) f s ST 501, 502 Basic Statistical Analysis Prerequisite: ST 311 or equivalent or graduate standing Basic concepts of statistics; random variables, distributions, statistical measures, estimation, tests of significance, analysis of variance, elementary design and sampling, factorial experiments, multiple regression, analysis of discrete data, and other topics. Intended primarily for statistics majors and Ph.D. minors and not intended as a service course for other departments. Mr. Steel 2 · · · ·

ST 511 Experimental Statistics for Biological Sciences I Prerequisite: ST 311 or graduate standing

Basic concepts of statistical models and use of samples; variation, statistical measures, distributions, tests of significance, analysis of variance and elementary experimental design, re-Messrs. Monroe, Rawlings gression and correlation, chi-square.

3 (3-0) f s ST 512 Experimental Statistics for Biological Sciences II Prerequisite: ST 511 or equivalent Covariance, multiple regression, factorial experiments, individual degrees of freedom, incomplete block designs, experiments repeated over space and time. Mr. Mason

EXPERIMENTAL STATISTICS 307

Experimental Statistics for Social Sciences I ST 513 3 (3-0) 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 Prerequisite: ST 513 or equivalent

Extension of basic statistical concepts to social experiments and surveys; sampling from finite populations and estimating using unrestricted, stratified, systematic, and multistage selections; analysis of variance continued; multiple regression; covariance; experimental designs.

Mr. Proctor

3 (3-0) f s

ST 515, 516 **Experimental Statistics for Engineers**

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. Mr. Hader

ST 521 Basic Statistical Inference

Prerequisites: MA 522 and MA 511

Frequency distributions and moments; sampling distributions; introductory theory of point and interval estimation; tests of hypotheses. Mr. Grandage

ST 522 Basic Theory of Least Squares and Variance Components

Prerequisies: ST 521 and MA 405

Theory of least squares; multiple regression; analysis of variance and covariance; experimental design models; factorial experiments; variance component models.

1-3 credits by arrangement f s ST 591 **Special Problems** Development of techniques for specialized cases, particularly in connection with thesis and Graduate Staff practical consulting problems.

Courses for Graduates Only

ST 611, 612 Intermediate Statistical Theory

Prerequisites: ST 521, MA 512 and MA 405

This course will provide the additional theory, above that of ST 521, needed for many advanced theory courses. Many of the topics of ST 521 will be developed more rigorously, with more attention paid to mathematical aspects. Advanced probability theory; limit theorems, distribution theory, multinormal distributions. Statistical decision theory, theory of estimation, confidence regions, theory of tests of hypotheses, sequential tests, non-parametric methods.

3 (3-0) s

3 (2-2) s

3 (2-2) f

Mr. Anderson

3 (3-0) f s

Mr. Hall

ST 621 Statistics in Animal Science

Prerequisite: ST 502 or equivalent

Sources and magnitudes of errors in experiments with animals, experimental designs and methods of analysis adapted to specific types of animal research, relative efficiency of alternate designs, amount of data required for specified accuracy, student reports on selected topics. Offered in fall of 1963-64 and alternate years. Mr. Lucas

3 (2-2) s ST 622 Principles of Biological Assays (See ANS 622)

ST 623 Statistics in Plant Science

Prerequisite: ST 502 or equivalent

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

3 (3-0) f

3 (3-0) f

ST 626 Statistical Concepts in Genetics

Prerequisite: GN 512; Corequisite: ST 502 or equivalent

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 Mr. Cockerham analysis of quantitative inheritance.

ST 631 Theory of Sampling Applied to Survey Design

Prerequisites: ST 422; ST 502 or equivalent

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 Messrs. Proctor, Koop samples.

(RS 641) Statistics in Sociology ST 641

Prerequisite: ST 513 or equivalent

The application of statistical methods in sociological research. Emphasis on selecting appropriate models, instruments and techniques for the more frequently encountered problems Mr. Hamilton and forms of data.

ST 651 (AGC 651) Econometric Methods I

Prerequisites: ST 421; ST 502 or equivalent; AGC 641

The role and uses of statistical inference in agricultural economic research; measurement problems and their solutions arising from the statistical model and the nature of the data; limitations and interpretation of results of economic measurement from statistical techniques. Topics include the problems of specification, aggregation, identification, multicollinearity and autocorrelation. Attention also is given to expectations models and simultaneous stochastic Mr. Wallace equations.

ST 652 (AGC 652) Econometric Methods II

Prerequisites: ST 422 and AGC 551

Techniques for problem analysis in agricultural economics; attention to analysis of time series data; non-parametric inference; experimental design in economic research; estimation of parameters in production functions and in simultaneous models; selected special topics. Mr. Anderson

Advanced Special Problems ST 661

Prerequisites: ST 502 or equivalent; ST 522

Any new advance in the field of statistics which can be presented in lecture series as unique opportunities arise, including (a) theory of sampling applied to survey design and (b) analysis Graduate Staff, Visiting Professors of messy data.

3 (3-0) f

3 (3-0) f

3 (3-0) f

3 (3-0) s

1-3 credits by arrangement f s

ST 671 Advanced Topics in Least Squares and Variance Components Prerequisites: ST 502 or equivalent; ST 522

Use of non-balanced designs to estimate variance components; comparison of estimators; problems with finite populations. Least squares procedures for non-standard conditions; unequal variances, correlated errors, non-additivity, measurement errors, non-normality. Functional relationships. Factorial experiments with continuous factor levels; incomplete blocks.

Mr. Anderson

ST 672 Special Advanced Topics in Statistical Analysis 3 (3-0) f Prerequisites: ST 502 or equivalent; ST 522 Enumeration data; covariance; non-linear models; discriminant functions and other multi-Mr. Monroe variate techniques.

ST 674 Advanced Topics in Construction and Analysis of Experimental Designs 3 (3-0) s Prerequisites: ST 502 or equivalent; 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 Graduate Staff of groups of means.

3 (3-0) s

FOOD SCIENCE 309

1(1-0) f s

A maximum of two credits is allowed toward the master's degree, but any number toward the doctorate. Graduate Staff

ST 691 Research

Seminar

ST 681

Credits by arrangementfs A maximum of nine credits is allowed toward the master's degree; no limitation on credits in doctorate programs. Graduate Staff

Food Science

Courses for Undergraduates

FS 301 **Food Composition**

Prerequisite: CH 220 or 221

Basic principles and procedures for the analysis of moisture, ash, carbohydrate, fat and protein contents of foods. Measurement of certain physical characteristics of foods.

Mr. Warren

FS 303 (ANS 303) Meat and Meat Products

Prerequisite: CH 351 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. Mr. Blumer

FS 309 (ANS 309) Meat Selection

Detailed consideration of factors involved in selection of carcasses and wholesale cuts of beef, pork and lamb. Practice in identification of wholesale and retail cuts. Mr. Craig

S. *

FS 331 (AGE 331) Food Engineering

Prerequisite: PY 211 or 221

Basic engineering principles applicable, wholly or in part, to food processing. Forms of energy and how they can be altered in state, composition, direction or force to fulfill the processing requirements. Latest means of energy conversion to affect efficient and practical applications to power, heat, refrigeration and irradiation. Instruments and controls for processing with applicable principles of fluid flow, heat transfer, air-vapor relationships, filtration, separation and materials handling by mechanical and flotation methods. Mr. Jones

FS 401 Market Milk and Related Products 3 (2-3) f

1 (0-6) f

3 (2-3) s

3 (2-3) f

3 (2-3) s

Principles of processing, distribution and quality control of fluid milk and related products. Mr. Warren

Ice Cream and Related Frozen Dairy Foods FS 403 3 (2-3) s Prerequisite: FS 401 Choice, preparation and processing of ingredients and freezing of ice cream and other frozen

desserts. Mr. Warren

FS 404 (PO 404) Poultry Products

Prerequisites: CH 101 and ZO 103 Selection, processing, grading and packaging poultry meat and eggs. Factors involved in preservation of poultry meat and eggs. Mr. Fromm

FS 410 Food Products Evaluation

Prerequisite: ST 361

A comprehensive study of problems encountered in new food product development and consumer acceptance. A study of the nature of sensory responses with emphasis on taste, smell and appearance (color) as related to foods; design and methodology of small and large consumer panel testing; and the application of appropriate mathematical procedures to food acceptance testing and methodology. Mr. Hoover

3 (2-3) s

3 (2-3) f

Courses for Graduates and Advanced Undergraduates

FS 502 Food Chemistry

Prerequisite: CH 220 or 221

The basic composition, structure and properties of food, and the chemistry of changes occurring during processing and utilization of the food. Interpret and integrate widely published data in the food field with basic principles of chemistry. Mr. Aurand

FS 503 Food Analysis

Prerequisites: CH 215, CH 351 and FS 502

A study of the principles, methods and techniques necessary for quantitative physical and chemical analyses of food and food products. Results of analysis will be studied and evaluated Mr. Aurand in terms of quality standards and governing regulations.

FS 505 (BO 505) Food Microbiology

Prerequisite: BO 412

The relationship of habitat to the occurrence of microorganisms on foods; environmental factors affecting the growth of various microorganisms in foods; microbiological action in relation to food spoilage and food manufacture; physical, chemical and biological destruction of microorganisms in foods; methods for microbiological examination of food stuffs; and public health and sanitation bacteriology. Mr. Speck

FS 506 Advanced Food Microbiology

Prerequisite: FS 505 or consent of instructor

Ecology and physiology of microorganisms important in the manufacture and deterioration of various classes of foods; the identification of representative species of such microorganisms isolated from natural environments; principles of nutrition, symbiosis and bacteriophage activity in culture maintenance for food production. Mr. Speck

FS 511 **Food Science Seminar**

Prerequisite: Senior or graduate standing and consent of instructor A review and discussion of scientific articles, progress reports in research and special problems Graduate Staff of interest.

FS 512 Special Problems in Food Science

Prerequisite: Senior or graduate standing and consent of instructor Analysis of scientific, engineering and economic problems of current interest in foods. The scientific appraisal and solution of a selected problem. The problems are designed to provide Graduate Staff training and experience in research.

1-3 (arranged) f s

3 (2-3) s

3 (3-0) f

3 (1-6) s

3 (0-9) f

1 (1-0) s

FS 521, 522 Technology of Fruit and Vegetable Products 3 (2-2) f s Prerequisite: BO 412

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. Hoover

Courses for Graduates Only

1 (1-0) f s FS 601 Seminar in Food Science Preparation and presentation of scientific papers, progress reports of research and special Graduate Staff topics of interest in foods.

Special Research Problems in Food Science Credits by arrangement FS 602 Directed research in a specialized phase of food science designed to provide experience in research methodology and philosophy. Graduate Staff

Research in Food Science Credits by arrangement FS 603 Original research preparatory to the thesis for the Master of Science or Doctor of Philosophy Graduate Staff degrees.

311 FORESTRY

Forestry

Courses for Undergraduates

3 (2-3) s FOR 52 Small Private Forest Management Growing, harvesting and marketing timber products under small private ownership conditions. For Agricultural Institute students. Mr. Dyson

FOR 101 Introduction to Forestry

The profession of forestry, its scope and opportunities; conservation of natural resources. Mr. Preston

FOR 201 Wood Structure and Properties 3 (2-3) s Identification, structure, properties and uses of woods of economic importance in the United States. This course is a condensation of FOR 202, 203 with less emphasis. Mr. Carter

FOR 202 Wood Structure and Properties 1

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

Prerequisites: 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. Rice

FOR s204 Silviculture

Sophomore Summer Camp

Growth and development of forest stands; reproduction counts, type mapping thinning, and weeding; establishment and measurement of sample plots. Staff

FOR s205 Wood Machining Practicum

Sophomore Summer Practicum

Prerequisite: FOR 203

Laboratory exercises in machining of wood.

3 credits

3 (1-4) f

1 (1-0) f

3 (2-3) s

1 credit

Sophomore Summer Practicum Laboratory exercises in wood drying.	l cred Sta	ſf
FOR s207 Gluing Practicum Sophomore Summer Practicum Laboratory exercises in gluing wood and preparation of particle board.	1 cred Sta	li t
FOR s208 Wood Finishing Practicum Sophomore Summer Practicum Laboratory exercises in wood finishing.	1 cred Sta	lit
FOR s209 Plant Inspections Sophomore Summer Practicum Inspection of wood-using plants.	1 cred Sta	l it ıff
FOR s210 Mensuration Practicum Sophomore Summer Practicum Laboratory exercises in mensuration.	2 credi Sta	ts iff

FOR s211 Logging and Milling Practicum Sophomore Summer Practicum	2 credits
Practical exercises in logging and milling.	Staff
FOR s212 Graphic Methods Sophomore Summer Practicum	1 credit
Laboratory exercises in appropriate graphic methods.	Staff
FOR 219 Forest Economy and Its Operation Multiple use concept of forestry; economic principles underlying production; lems; factors which influence demand for forest products.	3 (2-2) s investment prob- Mr. Dyson
FOR s264 Protection	3 credits
Protection practices relating to fire, insects and disease.	Staff
FOR s274 Mapping and Mensuration Sophomore Summer Camp Collection of field data for stand and yield tables, stem analysis, timber sur suration, forest mapping.	3 credits rveys, basic men- Staff
FOR s284 Utilization Sophomore Summer Camp Trips to wood industries; expositions on manufacturing processes.	1 credit
FOR 301 Wood Processes I Prerequisites: FOR 203, 209 The processes of drying, gluing and finishing wood. Processes of reconstitutin board, hardboard and particle board. Basic requirements of various procedur Factors in selecting production methods.	4 (3-2) f ng wood as fiver- es and materials. Mr. Carter
FOR 302 Wood Processes II Prerequisites: FOR 203, 209	4 (3-2) s
The theories and techniques of converting raw wood into usable products by ing and chipping round wood. Included also is the processing of finished lu stock, plywood and other wood products.	milling, veneer- mber, dimension Mr. Carter
FOR 321, 322 Pulp and Paper Technology	3 (3-0) f s

3 (3-0) f s Brief survey of the physical and chemical characteristics of wood and cellulose. Chemistry and technology of the major mechanical, chemical and semi-chemical processes employed in the manufacture of pulp and paper. Mr. Hitchings

FOR 342 Fiber Analysis

3 (1-4) s Fiber microscopy; the determination of fiber measurement, quality, variation and identity in pulpwood. Mr. Barefoot

FOR 361, 362 Silvics

Prerequisite: Summer Camp

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. Messrs. Maki, Perry

FOR 372 Mensuration

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. Bryant

Wood Preservation FOR 401

Factors causing wood deterioration; preservative materials and treatments; wood by-products from mill and forest waste. Mr. Carter

3 (2-2) s

3 (2-3) f s

2 (1-3) s

313 FORESTRY

FOR 403 Paper Process Analysis 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

Management Analysis FOR 404

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.

Messrs. Lammi, Miller

3 (1-6) s

FOR 405 **Forest Inventory**

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Timber estimating and data compilation.

3 (3-0) f s FOR 411, 412 Pulp and Paper Unit Processes Principles of operation, construction and design of process equipment employed in the pulp Mr. Cook and paper industry.

Paper Properties and Additives FOR 413

Physical, chemical and microscopical examination of experimental and commercial papers and evaluation of the results in terms of the utility of the product tested; evaluation and identification of dyestuffs and the development of color formulas.

Messrs. Cook, Landes

FOR 422 Forest Products

Prerequisites: FOR 201, CH 203 or 426

The source and method of obtaining derived and manufactured forest products other than Mr. Carter lumber.

FOR 423 Logging and Milling

Timber harvesting and transportation methods, equipment and costs; safety and supervision; Mr. Barefoot manufacturing methods with; log and lumber grades.

FOR 432 Merchandising Forest Products

Principles and practices in the distribution and marketing of the products obtained from wood; organization and operation of retail, concentration and wholesale outlets.

FOR 434 Wood Operations I

Prerequisites: FOR 301, 302

Organization of manufacturing plans producing wood products including company organization, plant layout, production planning and control. Analysis of typical manufacturing operations in terms of processes, equipment, size and product specification. The organization and operation of Wood Products markets. Mr. Barefoot

3 (3-0) f

4 (1-9) f

3 (2-3) f

2 (2-0) f

Mr. Carter

3 (2-3) f

3 (1-6) s Messrs. Lammi, Miller

FOR 435 Wood Operations II

Prerequisites: FOR 301, 302

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. Development of product distribution systems. Mr. Barefoot

FOR 441 **Design of Wood Structures**

Prerequisite: EM 341

Strength and related properties of commercial woods; standard A.S.T.M. strength tests; toughness; timber fastening; design of columns; simple, laminated and box beams; trusses and Mr. Thomas arches.

Introduction to Quality Control FOR 444

Prerequisite: ST 361 A study of methods used to control quality of manufactured wood products. Control charts for variable and attributes. Acceptance sampling techniques. Mr. Barefoot

3 (2-3) s

3 (2-3) s

3 (2-3) s

1 (1-0) s FOR 461 Paper Converting A survey of the principal processes by which paper and paper board are fabricated into the utilitarian products of everyday use. Mr. Landes

FOR 462 Artificial Forestation

Production collection, extraction, and storage of forest tree seeds; nursery practice; field methods of planting. Mr. Maki

FOR 463 Plant Inspections

One week inspection trips covering representative manufactures of pulp and paper and paper-making equipment. Staff

FOR 471 Pulping Process Analysis

Preparation and evaluation of the several types of wood pulp. The influence of the various pulping and bleaching variables on pulp quality and studied experimentally and these data evaluated critically. Mr. Hitchings

Pulping Processes and Products FOR 481

Prerequisites: FOR 202, CH 203 or 221

Fiber manufacturing process and equipment; wall, insulation and container board products; manufacture of roofing felts; pulp products manufacturing; resin treated and specialty products, lignin and wood sugar products. Mr. Landes

FOR 482 Pulp and Paper Mill Management

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 execu-Mr. Cook tives who administer them.

FOR 491 Senior Problems

Problems selected with faculty approval in the areas of management or technology. Staff

FOR 492 Senior Problems

Credits arranged Problems selected with faculty approval in the areas of management or technology. Staff

Courses for Graduates and Advanced Undergraduates

FOR 501 **Forest Valuation**

3 (2-2) f

2 (2-0) s

2 (1-3) s

1 (0-3) s

4(1-9) f

2 (2-0) s

Credits arranged

Prerequisite: FOR 372

The theory and techniques of valuation of forest land, timber stands, and forest practices as investments and for appraisals of damage. Risks and hazards in forestry as they apply to forest investments, forest insurance, and forest taxation. Mr. Bryant

FOR 511 Silviculture

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

Prerequisites: FOR 372, EC 201 Economics and social value of forests; supply of, and demands for forest products; land use; forestry as a private and a public enterprise; economics of the forest industries.

Mr. Lammi

2 (1-3) s FOR 513 Tropical Woods Prerequisites: FOR 203, 301 Structure, identification, properties, characteristics and use of tropical woods, especially those used in plywood and furniture. Mr. Barefoot

3 (3-0) s

3 (3-0) f

Forestry 315

FOR 521, 522 Chemistry of Wood and Wood Products 3 (2-3) f s Prerequisites: FOR 202, CH 215, 426, PY 212

Fundamental chemistry and physics of wood and wood components; pulping principles; electrical and thermal properties. Mr. Stamm

FOR 531 Forest Management

Prerequisite: 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 532 Forest Management

Continuation of FOR 531

FOR 533 Advanced Wood Structure and Identification

Prerequisite: FOR 202

Advanced microscopic identification of the commercial woods of the United States and some tropical woods; microscopic anatomical features and laboratory techniques.

Mr. Barefoot

FOR 553 Forest Photogrammetry

Prerequisites: FOR 372, 531 Interpretation of aerial photographs, determination of density of timber stands and area Mr. Bryant mapping.

Advanced Forest Mensuration FOR 571

Prerequisites: ST 311, FOR 372

Study of cyclical variation in growth of individual trees and stands; analysis of stand structures in even-aged versus all-age stands; general concepts of growing stock levels on yields; evaluation of growth prediction methods. Mr. Bryant

Forest Policy FOR 572

Prerequisites: EC 201, FOR 219; Corequisite: FOR 531

Analysis of the forest policies of the United States and selected foreign countries; criteria for their evaluation; appraisal of current policies and alternatives. Mr. Lammi

Methods of Research in Forestry FOR 573

Prerequisite: Senior or graduate standing Research procedures, problem outlines, presentation of results; consideration of selected studies by forest research organizations; sample plot technique.

3 (3-0) f

3 (2-2) f

3 (3-0) s

2(1-3)f

2 (1-3) s

3 (2-3) f

FOR 591 Forestry Problems

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

Credits arranged FOR 601 Advanced Forest Management Problems Prerequisite: Graduate standing Graduate Staff Directed studies in forest management.

Technology of Wood Adhesives FOR 603

Prerequisites: CH 425, 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. Mr. Hart

3 (3-0) f or s

Credits arranged

FOR 604 Timber Physics

Prerequisite: 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. Messrs. Ellwood, Hart

FOR 605 Design and Control of Wood Processes 3 (3-0) f or s Prerequisite: FOR 604 Design and operational control of equipment for processing wood. Mr. Ellwood

FOR 606 Wood Process Analysis

Prerequisites: FOR 512, 604

Analysis of wood processes through the solution of comprehensive problems involving the physics of temperature and moisture relations. Mr. Ellwood

FOR 607 Advanced Quality Control	3 (3-0) s
Prerequisites: FOR 606, ST 515	
Advanced statistical quality control as applied to wood processing.	Mr. Hart

FOR 611 Forest Genetics

Prerequisites: GN 411 and permission of instructor

Application of genetic principles to silviculture, management and pulp utilization. Emphasis is on variations in wild populations, on the bases for selection of desirable qualities and on fundamentals of controlled breeding. Mr. Zobel

FOR 621 Advanced Wood Technology Problems Prerequisite: Graduate standing	Credits arranged
Specific forestry problems that will furnish material for a thesis.	Graduate Staff
FOR 671 Problems in Research Prerequisite: Graduate standing Specific forestry problems that will furnish material for a thesis.	Credits arranged Graduate Staff
FOR 681 Graduate Seminar Prerequisite: Graduate standing in Forestry or closely allied fields	1 (1-0) f or s

Presentation and discussion of progress reports on research, special problems and outstanding publications in forestry and related fields. Graduate Staff

3 (3-0) f or s

3 (3-0) f or s

3 (3-0) f

Genetics

Courses for Undergraduates

GN 301 Genetics in Human Affairs 3(3-0) f sFundamental 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

The Principles of Genetics GN 411

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 (ANS 503) Genetic Improvement of Livestock 3 (2-3) f s

GN 512 Genetics

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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

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

3 (3-0) f

3 (3-0) s

GN 520 (PO 520) Poultry Breeding

GN 532 Biological Effects of Radiation

Prerequisite: ZO 103 or with consent of instructor

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

GN 540 Evolution

Prerequisite: GN 411

The facts and theories of evolution in plants and animals. The causes and consequences of organic diversity.

(Offered in 1962-63 and alternate years)

GN 541 (CS 541, HS 541) Plant Breeding Methods

Prerequisites: GN 512, and either ST 511 or consent of instructor Principles and methods of plant breeding.

GN 542 (CS 542 or HS 542) Plant Breeding Field Procedures 2 (0-4) Summer session

GN 550 Experimental Evolution

Prerequisites: GN 512 and either GN 513 or consent of instructor

4 (3-2) f

4 (3-2) f

2 (2 0) 6

3 (3-0) f

Mr. Smith

3 (3-0) s

Staff

Experimental evolution deals primarily with micro-evolutionary processes examined at the inter- and intra-specific population level. A review of the results from experimental population studies and analyses of natural populations concerning variation patterns and adaptation, natural selection, polymorphism, introgression, population breeding structure, isolating mechanism, etc., is made and interpreted in relation to Neo-Darwinian concepts of the origin of species.

(Offered in 1963-64 and alternate years.)

Mr. Mettler

Courses for Graduates Only

GN 602 (ANS 602) Population Genetics in Animal Improvement 3 (3-0) f

GN 607 (PP 607) Genetics of Fungi3 (3-0) fPrerequisite: GN 513 or graduate standing in Botany and ZoologyReview of major contributions in fungus genetics with emphasis on principles and theoriesthat have evolved in recent developments.Mr. Nelson

- GN 611 (FOR 611) Forest Genetics 3 (3-0) f s
- (20) (

GN 614 Cytogenetics II Prerequisite: GN 513 or consent of instructor	3 (0-6) s
Laboratory and discussion. The cytogenetic analysis of natural and experim plant and animal. Assigned exercises and student projects. The course provide with a working knowledge of cytogenetic procedure.	nental material, les the student
(Offered in 1963-64 and alternate years.)	Mr. Smith
GN 626 (ST 626) Statistical Concepts in Genetics	3 (3-0) s
GN 631 Mothematical Genetics Prerequisites: GN 512 and ST 511 or consent of instructor	3 (3-0) f
History of mathematical biology, role of mathematical concepts in the developm science, theory of genetic recombination, dynamics of genetic population.	ment of genetic
(Onered in 1905-04 and alternate years.)	Mr. Kojima
Prerequisite: GN 512	3 (3-0) s
Recent advances in physiological genetics. Attention will be directed to lite nature and action of genes, and to the interaction of heredity and environomen sion of the characteristics of organisms.	erature on the t in the expres- Mr. Grosch
GN 641 Colloquium in Genetics Prerequisites: Graduate standing and consent of instructor	2 (2-0) f s
Informal group discussion of prepared topics assigned by instructor.	Graduate Staff
GN 651 Seminor Prerequisite: Graduate standing	1 (1-0) f s
GN 661 Research Prerequisite: Graduate standing	Arranged
Original research related to the student's thesis problem. A maximum of six master's degree; by arrangement for the doctorate.	credits for the Graduate Staff
GN 671 Special Problems in Genetics Prerequisites: Advanced graduate standing and consent of instructor	1 to 3 f s
Special topics designed for additional experience and research training.	Graduate Staff
	8 - E - S

Courses for Undergraduates

MIG 101 Earth Science

Elective. Not to be taken after MIG 120

100

Introductory course in General Geology; changes in the earth, and underlying physical and life processes. n ng∰ ∰ (ani2 # 3

Geological Engineering

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.

MIG 220 Physical-Historical Geology

Prerequisite: CH 101

A broad introductory survey of earth materials, processes, and history. Common minerals and rocks. Effect of solar, gravitational, chemical, and internal thermal energy in transforming crustal constitution, structure, position, and surface form. Measurement and subdivision of geologic time. The time scale. Geosynclinal and tectonic cycles. Typical major geologic events in North America. Evolution of the main fossil groups.

4 (3-3) f

3 (3-0) s

319 GENETICS

MIG 222 **Historical Geology**

Prerequisite: MIG 120

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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.

MIG 323 Paleontology

Prerequisite: MIG 220 or 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.

Crystallography and Optical Microscopy MIG 331

Prerequisites: CH 103 and PY 202

The crystalline state, elements of morphologic crystallography, space lattice structure, and crystal chemistry. Crystal symmetry, systems, classes, and common forms. Atomic and ionic packing, coordination number, polymorphism, isomorphism, twinning, zoning, exsolution and replacement effects. Techniques and underlying optical theory for identifying minerals with the polarizing microscope. Determination of index of refraction and birefringence; isotropic, uniaxial, or biaxial character; optic angle, sign, and orientation. Adjunct apparatus for statistical and petrographic studies.

MIG 351 **Tectonic Structures**

Prerequisite: MIG 220

Application of the principles of mechanics to an understanding of rock deformation. Analysis of fracture, solid flow, and fluid flow structures imposed on igneous, sedimentary and metamorphic rock masses by internal crustal forces and gravitiational movements. Stressstrain relations of rocks and minerals under surface conditions, and the modification of behavior which result from pore solutions and increase of confining pressure, temperature, and time.

MIG 415 Mineral Exploration and Evaluation

Prerequisites: MIG 440, MIG 452

Application of the principles of geology, geophysics, and geochemistry to the discovery and evaluation of mineral deposits. Design of mineral exploration and development programs based on knowledge of the unique thermodynamic, geochemical, and tectonic features that control mineral formation and concentrations in well known mining districts, especially those yielding ferrous, base, and precious metals. Review of economic and technological factors governing the value of mineral deposits.

MIG 440 **Endogenic Materials and Processes** Prerequisites: MIG 220, MIG 331

3(2-3) fs

3 (2-3) f

4 (2-4) f

3 (2-3) f

3 (2-3) s

Minerals, rocks, and mineral deposits that are formed at high temperatures and pressures by crystallization or solidification of molten magma, or by solid state recrystallization of older rocks. Application of principles of thermodynamics and of phase-rule chemistry, and the results of modern high pressure-temperature laboratory research on the stability fields of crystalline phases, to an understanding of igneous and metamorphic rocks. Identification, classification, occurrence, origin, and economic value of the principal igneous and metamorphic rocks.

Exogenic Materials and Processes MIG 452

Prerequisites: MIG 220, MIG 331

Identification, classification, geologic occurrence, origin, and economic value of minerals, rocks, and mineral deposits formed by physical, chemical, and biological processes at low temperatures and pressures at and near the earth's surface. Hydrodynamics of sediment transport and deposition, settling velocities and size sorting, chemical and biochemical precipitation from aqueous solutions. Principles of division of stratified terranes into natural units, correlation of strata, identification of depositional environments, and facies analysis.

Engineering Geology MIG 461

Prerequisite: MIG 120 or 220

The application of geologic principles to engineering practice; analysis of geologic factors and processes affecting specific engineering projects.

3 (3-0) f

4 (3-3) f

MIG 462 **Geological Surveying**

Prerequisites: MIG 351, MIG 440, MIG 452

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.

Geological Field Procedures MIG 465

Prerequisite: MIG 351 or special permission

A six week summer field course. Practical field procedures and instruments commonly used to procure geologic data for evaluating mineral deposits, solving engineering problems involving earth materials, and drawing scientific conclusions. Observation of geologic phenomena in their natural setting. Large and intermediate scale geologic mapping of surface features and large scale mapping underground in mine workings.

Elements of Mining Engineering MIG 472

Prerequisites: MIG 220 and at least Junior standing in Geological Engineering Introduction to mining; surface and underground methods of development and production; explosives, drilling and blasting; ore loading, transport, and hoisting; drainage and ventilation; mine surveying and sampling; fire assaying; mining law, organization, administration, and safety. Lectures, laboratory and field inspections.

MIG 481, 482 Senior Seminar

Reports and discussion of current professional topics.

Courses for Graduates and Advanced Undergraduates

MIG 522 Petroleum Geology

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.

Mr. Leith

3 (2-3) s

MIG 552 Exploratory Geophysics

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. Spontaneous potential, resistivity, radioactivity, temperature, and other geophysical logging methods. Study of applications and interpretations of results. Mr. Leith

3 (1-6) s

6 Summer

3 (2-3) f

1 (1-0) f s

3 (3-0) s

MIG 571, 572 Mining and Mineral Dressing

Prerequisite: MIG 472

Principles of the mineral industry; mining laws, prospecting, sampling, development, drilling, blasting, handling, ventilation and safety; administration; surveying, assaying; preparation, Staff beneficiation and marketing.

Geomorphology MIG 581

Prerequisite: MIG 452 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 Prerequisites: MIG 440 and 452 Detailed study of the origin and occurrence of specific mineral deposits. Regional correlations. Graduate Staff

3 (2-3) f s

3 (2-3) f

3 (3-0) f s

MIG 632 Microscopic Determination of Opaque Minerals 3 (0-6) s Prerequisite: MIG 331

Identification of metallic, opaque minerals in polished sections by physical properties, etch reactions and microchemical tests. Laboratories. Mr. Brown

MIG 642 Advanced Petrography

Prerequisites: MIG 331 and 440

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

Prerequisite: Graduate standing

Scientific articles, progress reports and special problems of interest to geologists and geological engineers discussed. Graduate Staff

MIG 691 Geological Research

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

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.

3 (1-4) s

3 or 6

1 (1-0) f s

2 (2-0) f

HI 245, 246 History of European Civilization

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.

The United States Through Reconstruction HI 251

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

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.

The United States in Western Civilization HI 261 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.

3 (3-0) f s

3 (3-0) f s
HI 301, 302 American Economic History

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

The political, social and economic developments of North Carolina from colonial beginnings to the present.

HI 321 International Relations Since 1870

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 351 British History

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 375 Latin America

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

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

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

3 (3-0) f

3 (3-0) f s

3 (3-0) f

3 (3-0) s

3 (3-0) f

2 (2-0) f

3 (3-0) f s

2 (2-0) s

A study of the development of the American colonies in the seventeenth and eighteenth centuries, with special emphasis on European backgrounds.

HI 411 The American Revolution and the Confederation 3 (3-0) f The historical steps in the establishment of the United States as an independent nation. The conflict with Great Britain after 1763 leading to the declaring of independence; the military and diplomatic aspects of the war for American independence; the peace negotiations and the peace settlement of 1783; the domestic problems and foreign relations in the immediate post-war years; the establishment of government in the new nation terminating with the adoption of the Constitution of 1787.

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 422 History of Science 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.

3 (3-0) f HI 433 American Agricultural History 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 461 The Soviet Union (Same as EC, PS 461)

Prerequisites: One semester of Economics and PS 201 or HI 205 or acceptable substitute An analysis of the structure and function of the major Soviet economic, political and social institutions with special stress on the historical roots and continuity of Russian civilization. The course is presented in three equal phases of approximately five weeks each, covering Russian history, Soviet government, and Soviet economy.

Courses for Graduates and Advanced Undergraduates

HI 534 (Same as RS 534) Farmers' Movements

Prerequisite: Three credits in American history, American government, sociology or a related social science

A history of agricultural organizations and movements in the United States and Canada principally since 1865, emphasizing the Grange, the Farmers' Alliance, the Populist revolt, the Farmer's 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

3 (3-0) f s PS 201 The American Governmental System 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

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

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 322 Contemporary World Politics

A study of the pattern of international life, the instruments of national policy, the controls

3 (3-0) f

3 (3-0) f s

3 (3-0) f s

3 (3-0) f

3 (3-0) s

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 376 Latin American Government and Politics

An analysis of Latin American governmental structures, political parties and ideologies, with emphasis on the period since 1910 in Mexico, Cuba, Bolivia, Chile, Argentina, Brazil, Peru, and Venezuela. Agrarian reform, social revolution, nationalism, and relations with the United States will be stressed within the Latin American political context.

PS 401 American Parties and Pressure Groups

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.

3 (3-0) f s

3 (3-0) s

PS 406 **Problems in State Government**

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.

International Organization PS 431

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.

PS 452 The Legislative Process

A study of the formulation of public policy from the institutional and behavioral viewpoints. Important current legislative problems at the congressional and state legislative levels will be selected and will serve as a basis for analyzing the legislative process.

(Same as EC, HI 461) The Soviet Union PS 461

Courses for Graduates and Advanced Undergraduates

Modern Political Theory PS 501

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 Mr. Holtzman century to the present.

PS 502 Public Administration

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.

PS 510 (Same as EC 510) Public Finance

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

3 (3-0) s

3 (3-0) f

3 (3-0) f

3 (3-0) s

3 (3-0) f

3 (3-0) f s

Mr. Block

3 (3-0) f s

PS 512 American Constitutional Theory

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

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

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 regis-Graduate Staff tered for the course.

2-4 by arrangement f

2-4 by arrangement f

Horticultural Science

Courses for Undergraduates

HS 201 **Principles of Horticulture**

Attention will be directed to the basic principles involved in the application of these principles to the production, processing and utilization of fruit, vegetable, and ornamental corps. Attention will also be given to the economic importance and distribution of horticultural enterprises. Mr. Gardner

HS 211, 212 Ornamental Plants

Prerequisite: BO 103

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Distribution, botanical characters and relationships, adaptation and usage of ornamental trees, Mr. Randall shrubs, vines, and herbaceous plants.

HS 301 **Plant Propagation**

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

HS 342 Landscape Gardening

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. Randall

Nursery Management HS 411

Prerequisites: BO 103 and SSC 200

The principles and practices involved in the production, management, and marketing of fieldgrown and container-grown nursery plants. Field trips will be taken.

Messrs. Cannon, Randall

HS 421 Fruit Production

Prerequisites: BO 103 and SSC 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

HS 432 Vegetable Production

Prerequisites: BO 103 and SSC 200

3 (3-0) f s

3 (1-5) f s

3 (2-2) s

3 (2-3) f

3 (2-3) f

3 (2-3) f

3 (2-3) s

A study of the origin, importance, distribution, botanical relationships, and principles of production and marketing of the major vegetable crops. Mr. Miller

HS 441 Floriculture I

Prerequisites: BO 103 and SSC 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

HS 442 Floriculture II

Prerequisites: BO 103 and SSC 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

HS 471 Arboriculture

Prerequisites: BO 103 and SSC 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 Mr. Cannon trips will be taken.

3 (2-3) s

3 (2-3) s

3 (2-3) f

HS 481 Breeding of Horticultural Plants

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

HS 501 Research Principles

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

HS 541 (GN 541 or CS 541) Plant Breeding Methods 3 (3-0) f Prerequisite: GN 512; Recommended: ST 511 An advanced study of methods of plant breeding as related to principles and concepts of

HS 542 (GN 542 or CS 542) Plant Breeding Field Procedures 2 (0-4) s Prerequisite: HS 541 or CS 541 or GN 541 In summer sessions

Laboratory and field study of the application of various plant breeding techniques and methods used in the improvement of economic plants. Messrs. Harvey, Haynes

HS 552 Growth of Horticultural Plants

Prerequisite: BO 421

inheritance.

A study of the effect of nutrient-elements, water, light, temperature and growth substances on horticultural plants. Mr. Schramm

HS 562 Post-Harvest Physiology

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

HS 581 Senior Seminar

Prerequisite: Senior standing in Horticulture

Presentation of scientific articles, progress reports in research, and special problems in horticulture and related fields. Mr. Gardner

3 (2-3) s

3 (3-0) s

3 (2-2) f

Credits by arrangement

Messrs. Haynes, Timothy

1 (1-0) f s

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Courses for Graduates Only

HS 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

HS 641 Research

Prerequisites: Graduate standing in Horticulture, consent of chairman Original research on specific problems in fruit, vegetable, and ornamental crops. 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

HS 651 Seminar

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

Credits by arrangement

1 (1-0) f s

Industrial Arts

(See Education)

Industrial Education

(See Education)

Industrial Engineering

Courses for Undergraduates

IE 201 Industrial Engineering |

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

Prerequisite: IE 201 Continuation of IE 201

IE 217 Machine Tools

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

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

Classwork covers the description of cutting, sanding and assembly equipment, and an explana-

1 (0-2) f s

3 (2-3) f s

3 (3-0) f s

1 (0-2) f s

tion 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

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 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

Prerequisite: Junior standing

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Criteria and techniques of engineering economy for management decisions in relation to economy of design, economy of selection, and economy of operation. Study of effects of depreciation policies and machine replacement considerations. Emphasis on problem solving and development of detailed project economy studies.

3 (3-0) s

1 (0-3) f s

3 (3-0) s

1 (0-3) f s

IE 303 Industrial Engineering III

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

Prerequisite: IE 303 Continuation of IE 303

IE 310 Industrial Safety

A course in the causes and prevention of industrial accidents.

IE 322 Furniture Design and Construction

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

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

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

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

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.

4 (3-3) f

4 (3-3) s

2 (2-0) f s

4 (3-3) s

2 (0-6)

2 (2-0) f

3 (2-3) f

4 (3-3) f s

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.

Furniture Plant Layout and Design IE 341

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

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.

3 (2-3) f

4 (3-3) s

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IE 346 Furniture Design and Construction

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

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

Prerequisites: 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

Prerequisite: IE 401 Continuation of IE 401

IE 404 Introduction to Tool Engineering

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

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.

2 (2-0) f

3 (3-0) f

3(2-3)s

3 (3-0) s

3 (2-3) s

3 (2-3) f

IE 420 Manufacturing Controls

Prerequisite: IE 301

Theory and methodology for developing and maintaining profitable manufacturing operations. Development of principles and procedures for control of materials, manpower, and costs. Special attention to production and inventory control, equipment utilization, wage classification and cost reduction programs.

IE 425 Sales and Distribution Methods

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

Prerequisite: Senior standing

Job analysis, classification and specification. Grading, ranking, factor comparsion 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.

3 (2-3) s

2 (2-0) s

3 (3-0) f

IE 443 Quality Control

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

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

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

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

Prerequisite: IE 401

This course is designed to train the student in the problems and techniques required for systematic control of the production process and the business enterprise. This includes training in the determination of control factors, the collection and recording of data, and the processing, evaluation, and use of data. The course will illustrate the applications and use of data processing equipment and information machines in industrial processes. Case problems will be used extensively.

IE 531 Quantitative Job Evaluation Methods 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.

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1 (1-0) f s

3 (3-0) f

3 (3-0) f

3(3-0) f

IE 543 Standard Data

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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 546 Advanced Quality Control

Prerequisite: IE 304 or ST 362

The statistical foundation of Quality Control are emphasized in this course as well as its economic implications. Mathematical derivation of most of the formulas used are given. Sampling techniques are treated extensively and many applications of this powerful technique are explained.

IE 551 Standard Costs for Manufacturing

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.

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3 (3-0)

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3 (3-0) s

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IE 581 **Project Work**

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

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

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

Seminar discussion of industrial engineering problems for graduate students. Case analyses and reports.

Industrial Engineering Research IE 691

Graduate research in Industrial Engineering for thesis credit.

International Student Orientation

Introduction to the United States ISO 100 Required of all International students.

1 credit f

3 (3-0) f s

Credits by arrangement

1-1

Credits by arrangement

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Landscape Architecture

Courses for Undergraduates

LA 301, 302 Landscape Design I, II

Prerequisite: ARC 202

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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 com-Messrs. Moore, Thurlow plete third, fourth, and fifth year landscape cycle.

LA 311, 312 Landscape Construction I, II

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 Mr. Clarke fire protection.

4 (2-6) f s

5 (3-9) f s

LA 401, 402 Landscape Design III, IV

Prerequisite: LA 302

Required of students in Landscape Architecture

Regional survey investigation and analysis. Site planning and environmental design. 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.)

Messrs. Moore, Thurlow

LA 421, 422 Planting Design

Prerequisites: HS 212, LA 302, LA 312

Required of students in Landscape Architecture

The appraisal of plants as objects and their orderly arrangement for landscape effect. Techniques for recording design, specifications, and cost estimates. (Correlation with Landscape Design and Landscape Construction courses.) Mr. Moore

LA 501, 502 Landscape Design V, VI

Prerequisite: LA 402

Required of fifth year students in Landscape Architecture

Large scale landscape design and ecological planning, analysis, and investigation. At least one research or thesis project. Messrs. Moore, Thurlow

LA 511 Landscape Construction III

Prerequisite: LA 312

Required of fifth year students in Landscape Architecture Landscape structures, materials, and construction from LA 312. Office practice, procedure, ethics, and law; contracts, specifications, and bidding. Mr. Thurlow

Mathematics

Courses for Undergraduates

MA 101 Algebra and Trigonometry

5 (4-2) f s Algebraic properties of real numbers; algebra of sets, mappings, functions and graphs. Properties of the complex number field. Applications to systems of equations both linear and quadratic. Other topics in algebra including inequalities, variation, binomial theorem, progressions, theory of equations and determinants. Trigonometric functions of a general angle, identities and multiple angle relations, inverse trigonometric functions, graphs, solution of triangles by logarithms and slide rule with emphasis on the laws of sines and cosines.

MA 102 Analytic Geometry and Calculus I Prerequisite: MA 101

4 (2-6) f s

6,8 (4-8) f s

4 (2-6) f

6 (3-9) f s

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Required of freshmen in the Schools of Engineering and Physical Sciences and Applied Mathematics. The first of three semesters of a unified course in analytic geometry and calculus. Topics include rectangular coordinates in the plane, 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.

Algebra and Trigonometry MA 111

4 (3-2) f s Properties of real numbers and basic postulates, algebra of sets, functions and graphs, complex numbers. Linear and quadratic systems of equations. Inequalities, variation, progressions, binomial theorem, theory of equations and determinants. Trigonometric functions, identities, slide rule and logarithm solution of right and oblique triangles. (Students are to take either MA 101 or MA 111, but not both)

MA 112 Analytic Geometry and Calculus A

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 elementary practical problems.

4 (3-2) f s

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4 (3-2) f s MA 122 Mathematics of Finance and Elementary Statistics

Prerequisite: MA 101 or MA 111

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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 Analytic Geometry and Calculus II

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 unified course in analytic geometry and calculus. Topics 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

Prerequisite: MA 201

Required of sophomores in the Schools of Engineering and Physical Sciences and Applied Mathematics. The third of three semesters of a unified course in analytic geometry and calculus. Topics 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

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.

Introduction to Finite Mathematics MA 215

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.

Differential Equations 1 MA 301

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.

3 (2-2) f s

3 (3-0) f s

3 (3-0) f s

4 (3-2) f s

4 (3-2) f s

MA 302 Theory of Equations

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.

Differential Equations and Infinite Series MA 303

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, undetermined coefficients, operators. Systems of equations; scaling variables, applications to networks and dynamical systems. Introduction to series-solutions; solutions by use of analog computer; non-linear differential equations; dimensional analysis.

(Students are to take either MA 301 or 303, but not both.)

3 (3-0) f

4 (4-0) s

MA 335 Programming for Digital Computers

Prerequisites: MA 201 or MA 211 and junior standing

Programming for digital computers. Construction and use of flow charts, use of a compiler, and assembly program and machine language instructions.

Courses for Advanced Undergraduates

MA 401 Intermediate Differential Equations

Prerequisite: MA 301

Theory of linear independence of solutions of linear differential equations, variation of parameters, superposition integral, simultaneous linear differential equations by transform methods, series solutions, special functions (Bessel, Legendre, etc.), orthogonal functions, and partial differential equations by separation of variables.

MA 403 Fundamental Concepts of Algebra

Prerequisite: MA 202 or MA 212

Integers; integral domains; rational numbers; fields, rings, groups. Boolean algebra.

MA 404 Fundamental Concepts of Geometry

Prerequisite: MA 202 or MA 212

Foundations of geometry; laws of logic; affine geometry; geometric transformations; homogeneous coordinates; comparison of Euclidean and non-Euclidean geometries.

MA 405 Introduction to Determinants and Matrices

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 421 Theory of Probability I

Prerequisite: MA 301 or consent of department

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.

MA 433 History of Mathematics

Prerequisite: MA 202 or MA 212

Evolution of the number system; trends in the development of modern mathematics; lives

1 (0-3) f s

3 (3-0) s

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and contributions of outstanding mathematicians.

MA 441 Advanced Calculus I

3 (3-0) f s Prerequisites: MA 301 and, preferably, a B-average in all mathematics courses Vectors, differential calculus of functions of several variables, vector differential calculus.

MA 491 **Reading in Honors Mathematics**

Prerequisites: 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.

Courses for Graduates and Advanced Undergraduates

MA 512 Advanced Calculus II

3 (3-0) f s

Prerequisite: MA 511 Vector integral calculus, infinite series, integral calculus of functions of several variables.

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MA 513 Advanced Calculus III

Prerequisite: MA 512 Functions of a complex variable, partial differential equations, Fourier series.

MA 514 Methods of Applied Mathematics

Prerequisite: MA 512

Introduction to difference equations, integral equations, and calculus of variations.

MA 516 Principles of Mathematical Analysis

Prerequisite: MA 512

The real number system, elements of set theory, limits, continuity, differentiation, Reimann-Stieltjes integration, sequences of functions, fundamentals of Lebesque theory, topological and metric spaces.

MA 517 Introduction to Point-Set Topology

Prerequisite: MA 516

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 523 Theory of Probability II

Prerequisites: MA 405 and 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.

MA 527 Numerical Analysis I

Prerequisite: MA 511

Numerical solution of equations, introduction to the theory of errors, finite-difference tables and the theory of interpolation, numerical integration, numerical differentiation, and elements of difference calculus.

MA 528 Numerical Analysis II

Prerequisite: MA 527

Difference operators, summation procedures, numerical solution of ordinary differential equations, least-squares polynomial approximation, and Gaussian quadrature.

MA 532 Differential Equations II

Prerequisite: MA 511

Phase-plane concepts; elementary critical points and stability theory; second order linear equations with variable coefficients; general linear autonomous systems; forced oscillations of linear systems; the method of Frobenius; Bessel, Legendre and hypergeometric functions; regular singular points; Sturm-Liouville systems; eigenvalue problems and generalized Fourier expansions; existence and uniqueness theorems.

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3 (3-0) f

3 (3-0) s

MA 536 Logic for Digital Computers

Prerequisite: MA 511 Introduction to logic and formal languages of digital computers, algorithms, compilers, and heuristic programming.

MA 537 Non-numeric Uses of Computers

Prerequisite: MA 536

The use of computers in problems not involving numerical analysis. Formal differentiation and integration, algebraic models, combinatorics, theorem proving and decision making. Problems of mechanical translation. Special computers.

MA 555 (PY 555) Principles of Astrodynamics Prerequisites: MA 511, either PY 401 or EM 312 The differential equations of motion in two-body problems and their integrals; orbit theory; integrals of the n-body problem; differential equations of motion of natural and artificial satellites and their approximate solutions. Mr. Musen

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Courses for Graduates Only

MA 602 **Partial Differential Equations**

Prerequisite: MA 512

Ordinary differential equations in more than two variables, partial differential equations of the first order, partial differential equations of the second order, Laplace's equation, the wave equation, the diffusion equation.

Non-Linear Differential Equations MA 605

Prerequisites: MA 512, MA 532

Phase-plane and phase-space concepts; existence and uniqueness theorems; continuity, analytic and differentiability properties of solution; properties of linear systems; stability in non-linear systems; topological methods; perturbations of periodic solutions; asymptotic methods and Mr. Struble resonance problems.

MA 608 Integral Equations

Prerequisites: MA 512, MA 532

Linear Volterra intergral 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). Mr. Winton

3 (3-0) f **Complex Variable Theory and Applications I** MA 611 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 Mr. Bullock Schwarz-Christoffel transformation.

3 (3-0) s MA 612 Complex Variable Theory and Applications II

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 Mr. Bullock domain; structure of functions.

Alternate years 3 (3-0) f MA 615 Theory of Functions of a Real Variable I Prerequisite: MA 512 Sets and spaces; continuity and differentiability of real functions. Mr. Harrington

MA 616 Theory of Functions of a Real Variable II

Alternate years 3 (3-0) s

3 (3-0) Alternate summers

3 (3-0) s

3 (3-0) f

Prerequisite: MA 615 Measure, measurable sets and functions, theory of Lebesque integration.

Mr. Harrington

3 (3-0) f Introduction to Modern Abstract Algebra MA 621 Prerequisite: MA 512

A study of the abstract structure and properties of groups, rings and ideals, and fields. Messrs. Nahikian, Park, Wahab

MA 622 Vector Spaces and Matrices

Prerequisite: MA 511

A study of vector spaces and their relation to the theory of matrices. Matrix inversion, linear transformations, including similarity and orthogonal transformations, canonical forms. Properties of the characteristic and reduced characteristic function. Elementary divisors and functions of matrices. Applications to systems of differential equations.

Messrs. Nahikian, Park, Wahab

MA 625 Introduction to Differential Geometry

Prerequisite: MA 512

Theory of curves and surfaces in 3-dimensional euclidean space with special reference to those Messrs. Levine, Winton properties invariant under the rigid body motions.

Alternate summers 3 (3-0)

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MA 632 Operational Mathematics I

Corequisite: MA 513 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. Messrs. Cell, Harrington

MA 633 Operational Mathematics II

Prerequisite: MA 632

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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. Messrs. Cell, Harrington

MA 635 Mathematics of Computers

Prerequisites: MA 528, MA 512, MA 335; 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.

MA 641 Calculus of Variations

Prerequisite: MA 512

The simplest problem of the calculus of variations in detail; variable endpoints; isoperimetric 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

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 655 Mathematics of Astrodynamics I Prerequisite: MA 522 or MA 605

Prerequisite: MA 532 or MA 605

Two-body problem and its integrals, differential equations of the disturbed planetary motion, disturbing function (potential of the disturbed motion), literal and numerical methods for expansion of the disturbing function, perturbation of the first and second order, methods of Hansen, Hill, and Brouwer, theory of resonance.

MA 656 Mathematics of Astrodynamics II Prerequisite: MA 655

3 (3-0) f

Alternate summers 3 (3-0)

Alternate summers 3 (3-0)

3 (3-0) s

3 (3-0) s

Theories of artificial satellites, influence of the sun and moon on the motion of artificial satellites, orbit stability, lunar theories. Mr. Musen

MA 661 Tensor Analysis 1 Prerequisite: MA 512 The basic theory, tensor algebra, tensor calculus; invariants of quadratic differential forms; covariant differentiation; geometric applications, Reimannian spaces; generalized vector analysis. Mr. Levine

MA 662 Tensor Analysis II Prerequisite: MA 661 Continuation of MA 661. Physical applications; dynamics, Legrange's equations, the geometry of dynamics, cofiguration spaces. Further applications to electromagnetic theory and elasticity. 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

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

Prerequisites: Graduate standing and approval of adviser Individual research in the field of mathematics.

Mathematics and Science Education

(See Education)

Mechanical Engineering

Courses for Undergraduates

ME 101, ME 102 Engineering Graphics I, II

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

Prerequisites: MA 202 and 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.

up to 6 hours credit

Credits by arrangment

2 (1-3) f s

3 (3-0) f s

ME 302 Engineering Thermodynamics II

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

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

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.

3 (3-0) s

3 (3-0) s

3 (3-0) f

1 (0-3) f ME 305 Mechanical Engineering Laboratory I Corequisite: ME 301

Theory and principles involved in instrumentation and measurements. Limitation and sources of error of each technique studied. Utilization of the 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 Mechanical Engineering Laboratory II 1 (0-3) s

Prerequisite: ME 305; Corequisites: EM 301 and 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

Corequisite: EM 301

Required of juniors in Mechanical Engineering

The application of the principles of kinematics to the field of Mechanical Engineering.

ME 312 Dynamic Analysis

Prerequisites: ME 311 and 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 352 Aerodynamics

Prerequisites: EM 200 and 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 361 Aerospace Technology

Prerequisites: PY 202, EM 301, and MA 301

An introduction to the principles of flight in and beyond the atmosphere. Includes the elements of aerodynamics of flight, the reentry problem, flight dynamics, guidance and control, power generation in space, manned and unmanned space flight and life support systems.

ME 401 **Power Plants**

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 plan. Economic selection of components. Factors affecting the cost of power and the elements which enter into the problems arriving at monetary electric rates.

3 (3-0) s

3 (3-0) f

3 (3-0) s

3 (3-0) s

3 (3-0) f s

1 (0-3) f Mechanical Engineering Laboratory III ME 405 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.

1 (0-3) s ME 406 Mechanical Engineering Laboratory IV Prerequisite: ME 405 Individual or small group investigation of an original problem. A project type of program.

ME 410 Jet Propulsion

Prerequisite: ME 302 and ME 352 or EM 303

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.

3 (3-0) s

ME 411 Machine Design I

Prerequisites: ME 312 and EM 301

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

Prerequisite: ME 411

Required of seniors in Mechanical Engineering

Synthesis of machines, devices, and mechanical 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 421 Aerospace Propulsion Systems

Prerequisites: ME 361 and ME 302

A study of propulsion systems and their relation to the various flight regimes and space missions. The principles of thrust generation, the control, and the performance of various propulsion systems will be considered.

ME 435 Industrial Automatic Controls

Prerequisites: ME 301 and 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

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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 446 Performance of Hypervelocity Vehicles

Prerequisites: ME 361, ME 352

The application of the aerospace sciences to the estimation of the performance stability and control of hypervelocity vehicles.

ME 451 Introduction to Rocketry

Prerequisites: ME 301 and 352 or equivalent

Basic principles of rocket propulsion. Consideration of the significance and use of parameters such as specific impulse, characteristic velocity, thrust coefficient. General description of liquid, solid and hybrid power plants. Performance calculations and design considerations.

3 (3-0) s

3 (3-0) s

3 (3-0) f or s

1 (1-0) f or s

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3 (3-0) s

ME 453 Applied Aerodynamics Prerequisite: ME 352

Determination of design data, tunnel wall and ground effect interference corrections, spanwise and chordwise load distributions, performance estimation, and stability and control analysis. Attention is given to transonic and supersonic aerodynamics.

ME 465, 466 Aerospace Engineering Laboratory 1 (0-3) f s Prerequisite: ME 361

Laboratory experience in wind tunnel experimentation, structural testing, environmental testing, and instrumentation for flight in and beyond the atmosphere.

ME 469 Spacecraft Structures

Prerequisites: ME 361 and EM 301

To provide the basic structural background necessary to the design of light weight structures for flight in and beyond the atmosphere.

ME 471 Aircraft and Missile Design 3 (1-6) f Prerequisites: ME 361, ME 352

Elements of the design of modern aircraft and high-speed missile configuration to meet prescribed aerodynamic, structural, performance, and stability specifications.

3 (3-0) f

3 (3-0) f

MECHANICAL ENGINEERING 341

ME 472 Spacecraft Design

Prerequisite: ME 361

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A study of flight requirements leading to determination of flight criteria and the specifications of spacecraft systems. The application of aerospace sciences to the design of spacecraft.

Courses for Graduates and Advanced Undergraduates

ME 501 Steam and Gas Turbines

Prerequisites: ME 302 and EM 303 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

Prerequisites: ME 301 and MA 301

A study of the fundamental laws of heat transfer by conducting convection and radiation; steady and unsteady states heat transfer.

ME 503, 504 Elements of Nuclear Power Generation I, II 3 (3-0) f s Prerequisite: CHE 521

Engineering analysis and calculations involved in the elements of nuclear power generation including ideal and actual power cycles, prime movers and appurtenances. Elements of the cost of power and the engineering economics of selection of equipment. The nuclear reactor development and status as a source of power including a critical review of recent developments.

ME 507, 508 Internal Combustion Engine Fundamentals

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

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.

3 (1-6) s

3 (3-0) 4

3 (3-0) f or s

3 (3-0) f s

3 (2-3) f

ME 516 Photoelasticity

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

Prerequisite: EM 303

The theory of hydrodynamic lubrication; Reynold's equation, the Sommerfield 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

Prerequisites: ME 301, MA 301 and EM 303 or ME 352

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 multi-dimensional problems.

3 (2-3) s

3 (2-3) s

3 (3-0) f or s

ME 541, 542 Aerodynamic Heating Prerequisites: MA 511 and ME 521 or equivalent

A detailed study of the latest theoretical and experimental findings of the compressible laminar and turbulent boundary layers with special attention to the aerodynamic heating problem; application of theory in the analysis and design of aerospace hardware.

Project Work in Mechanical Engineering I, II 2 (0-4) f or s ME 545, 546 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

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

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

Prerequisite: ME 453

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

Prerequisite: ME 352

Development of fundamental aerodynamic theory. Emphasis upon mathematical analysis and derivation of equations of motion, airfoil theory and comparison with experimental results. Introduction to supersonic flow theory.

ME 562 Advanced Aircraft Structures

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

Prerequisite: ME 302

3(3-0) f s

3 (3-0) f

3 (3-0) f

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3 (3-0) f

3 (3-0) s

3 (3-0) s

3 (3-0) f

A fundamental study of summer and winter air conditioning including temperature, humidity, air velocity and distribution.

ME 572 Refrigeration

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.

ME 581, 582 Hypersonic Aerodynamics

Prerequisites: MA 512 and ME 352 or equivalent A detailed study of the latest theoretical and experimental findings in hypersonic aerodynamics.

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; metastables; thermodynamics of fluid flow.

3 (3-0) s

3 (3-0) f s

ME 602 Statistical Thermodynamics

Prerequisites: ME 601 and MA 511

Fundamental principles of kinetic theory, quantum mechanics, statistical mechanics and irreversible phenomena with particular reference to thermodynamics systems and processes. The conclusions of the classical thermodynamics are analyzed and established from the microscopic viewpoint.

ME 603 Advanced Power Plants

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 605 Aerothermochemistry

Prerequisites: ME 601 and 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 adiabatic 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

Prerequisites: ME 521, ME 601 and 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 nonlinear problem of shock wave formation, isentrophic plane flow, flow in nozzles and jets, turbulent flow.

ME 608 Advanced Heat Transfer I

Prerequisite: ME 502 or equivalent

Fundamental aspects, from an advanced viewpoint, will be considered in the conduction of heat through solids, convection 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

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.

3 (3-0) f

3 (3-0) s

3 (3-0) s

3 (3-0) f

3 (3-0) s

3 (3-0) s

ME 610 Advanced Topics in Heat Transfer 3 (3-0) f Prerequisite: ME 609

This course constitutes a study of recent developments in heat transfer and related areas. It is anticipated that the course content will change from semester to semester.

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 and 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, gyro-scopes, guidance and control systems, rotating and reciprocating devices.

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Mechanical Transients and Machine Vibrations ME 614

Prerequisites: ME 312 or EM 545 and 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 615 Aeroelasticity I

Prerequisites: MA 541, ME 411 or ME 459, ME 521

Deformations of aero structures under static and dynamic loads, natural mode shapes and frequencies; two and three dimensional incompressible flow, wings, and bodies in unsteady flow; statis aeroelastic phenomena.

ME 616 Aeroelasticity II

Prerequisites: MA 511, ME 615

Flutter; dynamic response phenomena such as transient landing stresses, gusts, continuous atmospheric turbulence; aeroelastic model theory, model design and construction.

ME 617 Plates and Shells in Mechanical Design

Prerequisites: MA 511 and 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 member to its environment.

ME 631 Applications of Ultrasonics to Engineering Research Prerequisites: MA 511 and EE 332

The technique and theory of propagation of ultrasonics in liquids, gases and solids. Development of ultrasonic transducers, the elastic piezoelectric, and dielectric relationships. Ultrasonic applications of asdic or sonor, cavitation, emulsification, soldering, welding, and acoustic properties of gases, liquids and solids.

ME 641 Mechanical Engineering Seminar 1 or 1 Faculty and graduate student discussions centered around current research problems and advanced engineering theories.

ME 642 Advanced Topics in Mechanical Engineering

Prerequisite: Graduate standing

Faculty and graduate student discussions of advanced topics in contemporary Mechanical Engineering.

1 to 6 credits f or s

3 (3-0) s

3 (3-0) s

3 (3-0) f

0-3

3-0

ME 645 Mechanical Engineering Research Credits by arrangement Prerequisites: Graduate standing in Mechanical Engineering and approval of adviser Individual research in the field of Mechanical Engineering.

ME 651 **Principles of Fluid Motion**

Prerequisite: ME 352 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.

Dynamics of Compressible Flow ME 652

3 (3-0) s Prerequisite: ME 521 or equivalent; Corequisite: MA 511 Properties of compressible fluids, equation of motion of one-dimensional motion, channel flows, shock wave theory, methods of observation, and flows at transonic speeds.

ME 653 Supersonic Aerodynamics

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.

3 (5-0) f

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3 (3-0) f

ME 654 Dynamics of Viscous Fluids

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Prerequisite: ME 555 or equivalent; Corequisite: MA 511

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

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.

ME 661, 662 Aerospace Energy Systems

Prerequisites: MA 512, ME 521, PY 407 or equivalent

A study of energy systems appropriate to the varied requirements of space operations. Includes analysis of chemical, nuclear and solar energy sources and the theory of their adaptation to operational requirements for propulsion and auxiliary power, cooling requirements, coolants and materials.

ME 671, 672 Advanced Air Conditioning Design I, II

Prerequisites: ME 571 and ME 572

The design of heating and air conditioning systems; the preparation of specifications and performance tests on heating and air conditioning equipment.

ME 691, 692 Advanced Spacecraft Design

Prerequisites: ME 542, ME 582 and MA 512

Analysis and design of spacecraft including system design criteria, acceleration tolerance, entry environment, thermal requirements, criteria for configuration design, aerodynamic design, heating rates, thermostructural design, boost phase, de-orbit, entry corridor, lift modulation, rolling entry, glide phase, maneuvering and landing, stability and control, thermal protection system, materials, instrumentation, and life support systems.

Metallurgical Engineering

Courses for Undergraduates

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) s

3 (3-0) s

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 Imporant applications of engineering materials and criteria for selection of materials.

MIM 321 Metallurgy

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

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.

3 (3-0) f s

3 (2-3) s

MIM 401, 402 Metallurgical Operations I, II

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

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

Corequisite: MIM 421 or MIM 422 Laboratory work to accompany Metallurgy I, II

MIM 431, 432 Metallography I, II

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

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

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 Metallurgy I, II Prerequisite: MIM 422 or MIM 432

2 (2-0) f s

1 (0-3) f s

3(2-3) f s

3 (1-6) f s

1 (1-0) f s

3 (3-0) f s

3 (3-0) f s

Theories concerning behavior and control of engineering alloys, reaction rates in the solid state and alloy influences; current heat treating practices, surface treatments; behavior of metals at high and low temperatures; special purpose alloys; powder metallurgy; review of modern equipment and methods for the study of metals.

MIM 523, 524 Metallurgical Factors in Design

Prerequisite: MIM 422 A study of the metallurgical factors that must be considered in using metals in design.

3 (2-3) f s MIM 541, 542 Principles of Corrosion I, II 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

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A systematic treatment of the fundamental physico-chemical principles governing the constitution of both metallic and ceramic materials. Correlation of these principles with physical, mechanical and chemical properties of materials. Particular emphasis is placed upon materials of construction for nuclear reactors. Lecture and laboratory.

MIM 562 Materials Problems in Nuclear Engineering

Prerequisite: MIM 561

Engineering aspects of problems involved in the selection and application of reactor materials. Specific attention is given to elevated temperature behavior, fatigue, corrosion, irradiation damage, and the fabrication and processing of these materials. Lecture and laboratory.

Courses for Graduates Only

MIM 651, 652 Theory and Structure of Metals

3 (3-0) f s

3 (2-3) 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

Classroom instruction is given in individual weapons and marksmanship, and organization of the Army. On the drill field, emphasis is placed on development of teamwork, esprit de corps, and essential characteristics of leadership.

1 (1-1) f

MS 102 Military Science I

Prerequisite: 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

Prerequisites: MS 101, MS 102, or equivalent credit

Classroom instruction in American Military History. 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

Prerequisites: MS I and MS 201 or equivalent credit

Classroom instruction in map and aerial photograph reading and introduction to operations and basic tactics. On the drill field emphasis is placed on development of teamwork, esprit de corps, essential characteristics of leadership, and acceptance of responsibility.

1 (0-3) s

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The Advanced Course

MS 301 Military Science III

Prerequisites: MS I and MS II or equivalent credit

Classroom instruction is given in military leadership, emphasizing the factors controlling the soldier's behavior and the problems of command; branches of the Army, emphasizing the mission of each in order to acquaint students with all branches prior to their ROTC Summer Camp and selection of branch in their senior year; principles of military planning and conduct of offensive and defensive tactics. 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

Prerequisite: MS 301

Classroom instruction is given in methods of military teaching with special reference to the leader's responsibility for soldier's learning; continuation of offensive and defensive tactics including communications in support of military operations; and a pre-camp orientation prior to ROTC Summer Camp. 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

Prerequisites: MS III, and satisfactory completion of six weeks' summer camp training Classroom instruction is given in military justice, troop movement, logistics, intelligence, 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

Prerequisite: MS 401

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

1 (2-1) f

1 (2-1) f

2 (2-1) s

2 (2-1) s

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.

English (Foreign Students)

MLE 101 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.

3 (3-0) f s

3 (3-0) f s

MLE 102 Elementary English: Composition

Emphasis in this course is laid upon the writing of English, special attention being given to compositions, grammatical exercises, sentence structure, spelling and diction.

French

MLF 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.

French Grammar and Prose Reading MLF 102

Prerequisite: MLF 101 or equivalent

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A survey of the basic elements of grammar accompanied and illustrated by intermediate readings progressing to the reading of standard texts.

French Prose: Selections From Modern French Literature MLF 201 3 (3-0) f s Prerequisites: MLF 101, MLF 102 or equivalent Selected readings from literary French. Attention given to the attainment of skill in reading and comprehension.

MLF 202 French Civilization

Prerequisites: MLF 101, MLF 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.

MLF 203 Review Grammar and Composition

Prerequisites: MLF 101, MLF 102 or equivalent

This course will bridge the gap between basic grammar courses and the more advanced literary courses preparing the student for the more advanced type of composition and conversation expected of him in the latter. It will also offer an opportunity for students with previous knowledge of a language from secondary schools to review grammar and obtain experience in an area not normally covered in their high school work.

MLF 301 Survey of French Literature

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.

MLF 401 Introductory Scientific French

This course is designed to present the grammar of scientific French as rapidly as possible in preparation for the reading course which follows.

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3(3-0) f s

MLF 402 Introductory Scientific French

Prerequisite: MLF 401 or equivalent

Reading and translation of technical French, supplemented by discussions on terminology, word order, vocabulary analysis and other linguistic techniques. Subject material adjusted to individual needs; conferences.

German

MLG 101 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.

MLG 102 German Grammar and Prose Reading

Prerequisite: MLG 101 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.

3 (3-0) f s

3(3-0) f s

3 (3-0) f s MLG 201 German Prose: Selections from Modern German Literature Prerequisites: MLG 101, MLG 102 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.

MLG 202 German Civilization

Prerequisites: MLG 101, MLG 102 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.

MLG 203 Review Grammar and Composition

Prerequisite: MLG 101, MLG 102 or equivalent

This course will bridge the gap between basic grammar courses and the more advanced literary courses preparing the student for the more advanced type of composition and conversation expected of him in the latter. It will also offer an opportunity for students with previous knowledge of a language from secondary schools to review grammar and obtain experience in an area not normally covered in their high school work.

Survey of German Literature MLG 301

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.

German Grammar for Graduate Students MLG 401

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.

MLG 402 Scientific German

Prerequisite: MLG 401 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.

Italian

MLI 101 Elementary Italian

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.

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3(3-0) f s

3 (3-0) f s MLI 102 Italian Grammar and Prose Reading Prerequisite: MLI 101 or equivalent A survey of basic elements of grammar accompanied and illustrated by intermediate readings, progressing to the reading of standard texts.

Russian

MLR 101 Elementary Russian

Basic structure of the language, supplemented by easy readings.

MLR 102 Russian Grammar and Prose Reading 3 (3-0) f s Prerequisite: MLR 101 A course for students who wish to attain proficiency in reading Russian. Attention given to basic grammar and the use of the written language.

MLR 201 Russian Prose: Selections from Russian Literature 3 (3-0) f s Prerequisites: MLR 101, MLR 102 or equivalent Selected readings from Russian literature. Grammar review and emphasis on vocabulary building and improvement in reading and speaking ability.

MLR 202 Russian Civilization

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Prerequisites: MLR 101, MLR 102

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.

Spanish

MLS 101 Elementary Spanish Structure, diction, pronunciation and other matters of technique of the language, supplemented by easy readings. No previous training in the language necessary.

MLS 102 Spanish Grammar and Prose Reading

Prerequisite: MLS 101 or equivalent

A survey of the basic elements of grammar accompanied and illustrated by intermediate readings progressing to the reading of standard texts.

MLS 201 Spanish Civilization

Prerequisites: MLS 101, MLS 102 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.

MLS 202 Hispano-American Civilization

Prerequisites: MLS 101, MLS 102 or equivalent

Empasis 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.

MLS 203 Review Grammar and Composition

Prerequisites: MLS 101, MLS 102 or equivalent

This course will bridge the gap between basic grammar courses and the more advanced literary courses preparing the student for the more advanced type of composition and conversation expected of him in the latter. It will also offer an opportunity for students with previous knowledge of a language from secondary schools to review grammar and obtain experience in an area not normally covered in their high school work.

MLS 301 Survey of Spanish Literature

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.

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

MLS 307, 308 Technical Spanish

Prerequisite: MLS 201 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.

MLS 401 Introductory Scientific Spanish 3 (3-0) f s This course is designed to present the grammar of scientific Spanish as rapidly as possible in preparation for the reading course which follows.

MLS 402 Introductory Scientific Spanish

Prerequisite: MLS 401 or equivalent

Reading and translation of technical Spanish, supplemented by discussion on terminology, word order, vocabulary analysis and other linguistic techniques. Subject material adjusted to individual needs; conferences.

General Courses

ML 321, 322 Romance Literature

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

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

Courses for Graduates and Advanced Undergraduates

NE 501 Nuclear Engineering Systems I

An introductory course in reactor theory and engineering including the fission process; neutron energy distribution; lethargy; neutron slowing, diffusion and interactions; Fermi age theory; the diffusion equation, criticality conditions; reactor instrumentation.

Graduate Staff

NE 502 Nuclear Engineering Systems II

Continuation of reactor theory from NE 501. Topics include treatment of reactor parameters for homogeneous and heterogeneous reactors; reflected reactors, two-group theory, reactor kinetics, temperature effects, control rod theory, perturbation theory and transport theory. Graduate Staff

NE 503 Nuclear Reactor Theory I

Course considers reactor as a system including aspects of reactor control, radiation protection, shielding and thermal design. Graduate Staff

NE 531 (PY 531) Nuclear Reactor Laboratory

Corequisites: PY 518, PY 530

Observation and measurements of static and dynamic nuclear reactor behavior, the effectiveness of control and temperature, and correlation with theory. Experiments of the motion and detection of neutrons and gamma-rays, with emphasis on the research uses of nuclear reactor radiations.

2 (2-0) s

2 (2-0) s

3

3 (3-0) f

3 (3-0) s

3 (3-0) s

1 (0-1) f s

Courses for Graduates Only

NE 619 (PY 619) Reactor Theory and Analysis I

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.

NE 620 (PY 620) Nuclear Radiation Attenuation

Prerequisites: PY 530, MA 512

Physical theory of the behavior of neutrons, gamma-rays and charged particles in matter. Calculation of source terms, attenuation factors, heating rates, geometrical transformations, radiation streaming and radioactive decay effects required in the design of nuclear radiation shields for reactors, accelerators, and space vehicles. Transport theory of gamma-ray and neutron transmission through matter. Analysis of experimental techniques for obtaining shielding data.

3 (3-0) f

3 (3-0) f

3 (3-0) s NE 630 (PY 630) Reactor Theory and Analysis II 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, energy dependent neutron transport theory, and multigroup machine methods.

Occupational Information and Guidance

(See Education)

Philosophy and Religion

Courses for Undergraduates

PHI 201 Logic

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Language as symbol system, the formal structure of reasoning, and characteristics of empirical knowledge; emphasis on the establishment of reflective habits.

PHI 203 Introduction to Philosophy

The course is designed (1) to acquaint the student with basic principles and problems of logic and theory of knowledge; (2) to develop ability in effective philosophical analysis and the formulation of one's own ideas in selected areas of contemporary concern.

Problems and Types of Philosophy PHI 205

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.

Religious Groups and Trends in the United States 2 (2-0) f s **REL 301** 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.

3 (3-0) f s

2 (2-0) f s

3 (3-0) f s

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 3(3-0) f sEthics Study of major ethical theories; systematic analysis of the nature of value judgments, and the concepts of moral obligation, right and good; personal and social aspects of human conduct.

3 (3-0) f s PHI 309 Marriage and Family Living Secular and religious concepts of marriage; physical, socio-psychological, and ethical aspects of premarital and marital relationships; parenthood; analysis of value judgments relative to marriage and family living; formulation of philosophy of marriage.

Parent-Child Relationships PHI 311

Principles of inter-personal relationships; democratic values and the attainment of growth by parent and child through freedom, responsibility, and creative activity; analysis of current theories of husband-wife, and parent-child relationships.

Philosophical Analysis PHI 395

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 judgment; major objective to afford personal participation in and acquaintance with philosophical analysis as intellectual tool with wide applicability.

PHI 401 Symbolic Logic

Modern methods in logic involving formalized expression that avoids inherent difficulties and ambiguities of ordinary language and makes possible greater effectiveness in handling complex material.

REL 403 Religions of the World

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

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

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

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2 (2-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

The College requires four semesters in physical education to be taken consecutively during the freshman and sophomore years. Each semester of physical education is divided into two eight-week courses or activities. These courses are divided into two areas; the areas are Prescribed Courses and Elective Sports Activities. In as much as staff, facilities, and allotment of time will permit, each student is directed into courses which will best meet his individual needs. The basis for determining the needs of the individual student are as follows:

- 1. Medical Examination. The required medical examination should give the College Health Service an awareness of unusual physical impairments that a student may have. If the student knows of any other possible reason for limiting his physical activity, he should inform the college physician. The college physician will then recommend possible limitations in activities to the Physical Education Department. Based on this recommendation, a special program will be arranged for the student involved. All medical recommendations must be cleared through the College Health Service.
- 2. Swimming Test. All students who have any requirement in physical education to meet, at State College, must take a swimming test. Those students who cannot pass the test are assigned to Beginning Swimming as their first course in physical education. This course must be passed, qualifying the student as a swimmer, before the physical education requirement is completed. Those students who pass the swimming test are further classified according to their ability level. This classification determines which swimming course they select first.

- 3. Athletic Ability Test. An athletic ability test is given to all freshmen during Freshman Orientation Week. Students who score below the 15th percentile are enrolled in a course in fundamental sports for two semesters or until they gain a level of ability which indicates they are ready for the basic sports program. The students who score between the 15th and the 75th percentile are enrolled in the basic sports program. Those who score above the 75th percentile are permitted to elect their activities along with the sophomores. All sophomores, juniors, and seniors are allowed to select activities of their choice.
- 4. Health Knowledge Test. All freshmen are required to take a health knowledge test during Freshman Orientation Week. Those who do not pass this test must take a course in hygiene for eight weeks (1/2 semester) in lieu of one physical education activity.

Requirements for Veterans and Transfer Students

- 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. Veterans or transfer students 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.

Courses

PE 101, 102

PE 201, 202

1 (0-2) f s

1 (0-2) f s

PE 301, 302, 303, 304 Junior and Senior electives

1 (0-2) fs 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.

Courses in Prescribed Sports Area

Beginning Swimming: Offered in the fall semester. A course designed for meeting the swimming 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 to prepare him for elective sports. Hygiene: Offered in the second half of the fall semester, and in the first half of the spring semester. A course designed to meet the health knowledge requirement and to guide the student to a more healthful way of life.

Courses in Elective Sports Area

All courses offered as elective sports are classified as Team Sports, Aquatics, Recreational Sports, Developmental Activities, or Varsity Sports. A student cannot repeat any course for credit. The courses are listed under their proper classification as follows.

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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.

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Aquatics:

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.

Water Sports: Offered in fall and spring semesters. A course to teach the skills of water-polo and water basketball, plus improvement in stamina and skill necessary to improving ability. This course may not be taken by those students who have progressed beyond Senior Life Saving.

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.

Recreational 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).

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.

Handball (Four Wall): Offered in both fall and spring semesters. A course designed to include the fundamentals, together with history and rules of handball.

Roller Skating: Offered during the second half of the fall semester and the first half of the spring semester. A course designed to teach the fundamentals of roller skating. Emphasis will be on body balance and control.

Squash: Offered in both fall and spring semesters. A course designed to include the fundamentals, together with history and rules of squash. 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.

Developmental Activities:

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.

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.

Advanced Gymnastics: Offered in the fall semester. A course designed for those students who wish to progress beyond the beginning course in gymnastics.

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.

Physical Sciences and Applied Mathematics

PSM 100 Orientation

0 (1-0) f

Introduction to the fields of the physical sciences and mathematics. Required of all new freshmen in the school. Staff

Physics

Courses for Undergraduates

PY 201, 202 General Physics

Corequisite: MA 201

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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 205, 206, 207 General Physics

Corequisite: MA 201

Intended primarily for majors in departments of the School of Physical Sciences and Applied Mathematics. A study of classical and modern physics in which fundamental principles are emphasized. Calculus is used throughout as needed. Demonstrations and laboratory work tend to emphasize the modern aspects for a firm foundation for further study in the physical sciences.

5 (3-4) f s; f s

4 (2-4) s; f; s
PY 211, 212 General Physics

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. Staff

PY 221 **College Physics**

Prerequisite: MA 111

Required in certain curricula of the School of Agriculture. An introduction to the origins of physical science, the fundamental principals 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 a brief survey of modern atomic physics. Lectures and demonstrations with class participation. Staff

PY 223 Astronomy and Astrophysics

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, temperature, 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. Mr. Snyder

Evaluation of Radiation Hazards PY 300

Prerequisites: PY 202 and CH 102

An introductory course on radiation and protection from the hazards of radiation designed principally for non-physics students. Fundamentals of radiation, radioactivity, and dosimetry. Biological effects. Maximum permissible exposure limits and MPC in air and water. Shielding, handling methods, decontamination, waste disposal, and monitoring techniques.

Mr. Story

PY 401 Mechanics

Prerequisite: PY 202; Corequisite: MA 301

An intermediate course in theoretical mechanics. Dynamics of particles and rigid bodies with an introduction to advanced dynamics. Lagrange's equations and simple applications, Lorents transformations and an introduction to the theory of special relativity. Mr. Moss

PY 402 Heat and Sound

Prerequisite: PY 302; Corequisite: MA 301

An intermediate course in the principles of thermodynamics, kinetic theory, heat transfer, and vibrations. Mr. Moss

PY 403 Electricity and Magnetism

4 (3-3) f s; s

5 (5-0) f s

3 (3-0) s

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3 (2-2) f s

4 (3-3) f

4 (3-3) s

Prerequisite: PY 202; Corequisite: MA 301 An intermediate course in the fundamentals of static and dynamic electricity, and electromagnetic theory. Mr. Doggett

PY 404 Optics	4 (3-3) s
Prerequisite: PY 202; Corequisite: MA 301	Valentati Balan de es
An intermediate course in physical and geometrical optics.	Mr. Doggett

3 (3-0) f s PY 407 Introduction to Modern Physics

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, ion accelerators, and nuclear reactions.

Staff

PY 410 Nuclear Physics I 4 (3-3) f s Prerequisite: PY 407

An introduction to the properties of the nucleus, and the interaction of radiation with matter. A quantitative description is given of natural and artificial radioactivity, nuclear reactions, Mr. Waltner fission, fusion, and the structure of simple nuclei.

PY 491 Senior Research

Prerequisite: Senior Honors program standing, except with special permission Investigations in physics under the guidance of staff members. Literature reviews, experimental measurements, or theoretical studies. A project report will be prepared. Staff

Courses for Graduates and Advanced Undergraduates

PY 501 Wave Mechanics

Prerequisites: PY 407, MA 511, and either PY 401 or PY 403 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.

Mr. Cobb

3 (3-0) f

Introduction to Theoretical Physics PY 503

Prerequisites: PY 401 or PY 403, MA 511

An introductory course which offers preparation necessary for advanced graduate study, presented from the viewpoint of vector and tensor calculus. Particle dynamics, Lagrange'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.

Mr. Freyre

3 (3-0) f

PY 507 Advanced Atomic Physics

Prerequisites: PY 401 or PY 403, MA 511

A study of atomic structure and spectra, with emphasis on the analysis of spectra. Topics include the alkali spectra, multiplet structure, electron spin, hyperfine structure, moments, etc. Mr. Cobb

PY 508 **Ionization in Gases**

Prerequisites: PY 401, PY 403, MA 301

Statistical theory of matter; excitation and ionization in gases; mobilities and conductivities; processes at solid surfaces in ionized gases; characteristic forms of electrical discharges in Mr. Bennett gases.

Plasma Physics PY 509

Prerequisite: PY 508

Individual and collective motion or charged particles in electric and magnetic fields and through ionized gases. Pinch effect, relativistic streams, conductivities, and runaway electrons. Astrophysical concepts and approximations. Properties of plasmas, including waves, confinement, instabilities and shocks, with applications. Mr. Bennett

3 (3-0) f

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PY 510 Nuclear Physics II

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. In the laboratory work, emphasis is placed on gaining experience in indepen-Mr. Waltner dent research.

Radiation Hazard and Protection PY 518

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 are analyzed. Mr. Underwood

3 (2-3) f s Physical Measurements in Radioactivity PY 520 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. Mr. Lynn

3 (3-0) f s

Prerequisites: PY 410, MA 401 or MA 511

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. Staff

PY 531 (NE 531) Nuclear Reactor Laboratory

Corequisites: PY 518, PY 530

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. Staff

PY 541 Special Problems in Physics

Prerequisite: Permission of department

Study and research in special topics of classical and modern physics. Experimental measurements with emphasis on the treatment and interpretation of data, literature surveys, or Graduate Staff theoretical investigations.

PY 552 Introduction to the Structure of Solids

Prerequisites: PY 202, MA 202; PY 403 and PY 407 are recommended Basic considerations of amorphous and crystalline solids, metals, conductors, and semi-con-Mr. Doggett ductors.

PY 555 (MA 555) Principles of Astrodynamics Prerequisites: MA 511, either PY 401 or EM 312

The differential equations of motion in two-body problems and their integrals; orbit theory; integrals of the n-body problem; differential equations of motion of natural and artificial satellites and their approximate solutions. Mr. Musen

PY 601, 602 Advanced General Physics

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. Mr. Davis

PY 610 Advanced Nuclear Physics

Prerequisites: PY 501, PY 510

Current hypotheses of nuclear structure and reactions including deuteron binding, neutronproton scattering, the compound nucleus, stripping reactions, shell structure, beta decay, neutron resonances, and mesons. The use of neutrons in present-day nuclear research is Staff emphasized.

1-3 credits by arrangement

3 (3-0) s

3 (3-0) f s

3 (3-0)

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1 (0-3) f s

PY 611 Quantum Mechanics

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. Mr. Davis

PY 612 Advanced Quantum Mechanics

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. Mr. Davis

PY 617, 618 Principles of Health Physics Measurements 2(1-3) f s Prerequisite: PY 510; Corequisites: PY 518, PY 520 recommended The physical principles underlying health physics measurements are studied both theoretically

and experimentally. The purpose of the course is to develop in the student an insight into the principles and problems involved in measuring radiation and determining dose.

Mr. Underwood

3 (3-0) f

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3 (3-0) s

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Seminar PY 670 1 (0-3) f s Literature surveys and written and oral presentation of papers on current topics in (a) general physics, (b) nuclear physics, (c) ionic phenomena of space physics, (d) plasma physics, (e) non-inertial space mechanics. Staff

PLANT PATHOLOGY 361

PY 619 (NE 619) Reactor Theory and Analysis I 3 (3-0) f

Prerequisite: PY 530

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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. Mr. Murray

PY 620 (NE 620) Nuclear Rediation Attenuation

Prerequisites: PY 530, MA 512

Physical theory of the behavior of neutrons, gamma-rays and charged particles in matter. Calculation of source terms, attenuation factors, heating rates, geometrical transformations, radiation streaming and radioactive decay effects required in the design of nuclear radiation shields for reactors, accelerators, and space vehicles. Transport theory of gamma-ray and neutron transmission through matter. Analysis of experimental techniques for obtaining Mr. Doggett shielding data.

PY 621 **Kinetic Theory of Gases**

Prerequisites: PY 501, PY 503, and MA 512

The theory of molecular motion, including velocity and density distribution functions; the phenomena of viscosity, heat conduction, and diffusion; equations of state; fluctuations.

Mr. Freyre

3 (3-0) s

PY 622 Statistical Mechanics

Prerequisites: PY 501, PY 503, MA 512, and PY 612

A treatment of statistical mechanics from both the classical and quantum points of view. Development of thermodynamic theories and application to atomic systems. Mr. Freyre

PY 630 (NE 630) Reactor Theory and Analysis II

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 and perturbation theory, neutron thermalization, energy dependent neutron transport theory, and multigroup machine methods. Mr. Murray

PY 631, 632 Atomic and Molecular Spectra

Prerequisite: PY 501

Atomic models and coupling schemes; multiplet series, Zeemen, Paschen-Back and Stark effects; hyperfine structure and complex spectra; spectra of polyatomic molecules; infrared and Ramen spectra. Applications adopted to the interest of the students in the course.

Staff

3 (3-0) f

3 (3-0) s

3 (3-0) f

3 (3-0) f s

PY 690 Research Credits by arrangement Graduate students sufficiently prepared may undertake research in some selected field of Physics. Staff

Plant Pathology

Courses for Undergraduates

PP 315 Plant Diseases

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. Powell

3 (2-3) f

PP 318 Diseases of Forest Trees

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

2 (2-0) s

Courses for Graduates and Advanced Undergraduates

PP 500 Advanced Plant Pathology

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 1 (0-3) s Diseases

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

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 1962 and alternate years)

Summer Session 3 (1-4)

3 (2-3) s

Mr. Hebert

Courses for Graduates Only

Phytopathology I PP 601

Prerequisites: 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

Prerequisites: PP 315, permission of the instructor The basic concepts of the etiology, pathology, epiphytology, and control of plant diseases. Mr. Nusbaum

PP 604 Plant Parasitic Nematodes

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

4 (1-6) f

4 (2-6) s

2 (1-3) f

PP 605 Plant Virology Prerequisites: PP 315, GN 411, and a course in organic chemistry A study of plant viruses including effects of host plants, transmission, cl	3 (1-6) f
of purification, determination of properties, chemical nature, structure, a (Offered in 1963-64 and alternate years)	nd multiplication. Mr. Hebert
PP 607 (GN 607) Genetics of Fungi Prerequisites: GN 512 or equivalent, permission of instructor	3 (3-0) f
Review of major contributions in fungus genetics with emphasis on pri-	nciples and theories
(Offered in 1962-63 and alternate years)	Mr. Nelson
PP 608 History of Phytopathology Prerequisites: PP 315, permission of instructor	1 (1-0) f
Development of the science of phytopathology from its early beginning t	to the early part of
(Offered in 1963-64 and alternate years)	Mr. Ellis

PP 609 Current Phytopathological Research under Field Conditions 2 (1-3) s Prerequisite: Graduate standing Study of concepts involved procedures used and evaluation made in summer abstance belowing

Study of concepts involved, procedures used, and evaluation made in current phytopathological research by Plant Pathology staff. Visits to various Research Stations will be made by the class. Mr. Clayton

PP 611 Nematode Diseases of Plants

Prerequisite: PP 604

A study of plant diseases caused by nematodes. Special consideration will be given to hostparasite relationships, host ranges, and life cycles of the more important economic species. Principles and methods of control will be considered. Mr. Sasser

PP 612 Plant Pathogenesis

Prerequisite: PP 500

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A study of interactions of pathogens and suscept plants. The following major topics will be considered: hydrolytic enzyme systems involved in tissue disintegration; role of enzymes, polysaccharides, and toxins in wilting phenomena; mode of action of toxins in altering plant metabolism; role of growth regulators in hypertrophic responses; alterations in respiration and other physiological processes during pathogenesis; and nature and biochemical basis for disease resistance.

(Offered in 1962-63 and alternate years)

3 (1-4) s

3 (2-3) f

PP 615 Research in Plant Pathology Prerequisites: Graduate standing and consent of instructor Original research in plant pathology.

PP 625 Seminar in Plant Pathology

Prerequisite: Consent of seminar chairman Discussion of phytopathological topics selected and assigned by seminar chairman.

Graduate Staff

1 (1-0) f s

Political Science

(See History and Political Science)

Mr. Kelman

Credits by arrangement

Graduate Staff

Poultry Science

Courses for Undergraduates

4 (3-3) f s PO 201 **Poultry Production** Principles of broiler, market eggs, hatching egg and turkey productions. Classes, breeds and varieties identification of chickens and turkeys. Breeding, incubation, raising, housing, feeding, and parasite control, marketing of chickens, eggs and turkeys. Messrs. Brown, Martin

PO 301 Poultry Quality Evaluations

Prerequisite: PO 201

Elective for others with permission of instructor.

Evaluation of poultry for production and standard qualities; determining market, poultry and Mr. Brown eggs.

PO 351 Poultry Grading

Prerequisite: PO 301 Laboratory experience in determining federal grades of poultry and eggs. Mr. Brown

PO 401 Poultry Diseases

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

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

1(1-0) f s

PO 403 Poultry Seminar

Current topics and problems relating to Poultry Science and to the poultry industry are assigned for oral report and discussion. Two semesters. Staff

2 (1-3) f

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1 (0-3) f

4 (3-3) s

4 (3-2) s

3 (2-3) f PO 404 (FS 404) Poultry Products 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 preser-Mr. Fromm vation of poultry meat and eggs.

Courses for Graduates and Advanced Undergraduates

3 (2-3) f PO 520 Poultry Breeding Prerequisite: GN 411 Required of Poultry Science majors. Application of genetic principles to poultry breeding, considering physical traits and physiological characteristics-feather patterns, egg production, hatchability, growth, body conforma-Mr. Martin tion and utility.

PO 521 Poultry Nutrition

Prerequisite: CH 220 or 221 Required of majors in Poultry Science; elective for others. 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 deficiencies in chicks for observation and examination. Mr. Kelly

PO 522 Endocrinology of the Fowl

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 602 Advanced Poultry Nutrition

Prerequisites: PO 521, CH 551 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**

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

Prerequisite: Graduate standing

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1-6 (arrange) f s

1-6 (arrange) f s

3 (2-3) s

3 (2-3) f

Product Design

PD 201, 202 Product Design and Orientation

Prerequisite: DN 102

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Required of second year students in Product Design

Elementary problems in form and function. Transitional implications of handcrafted and massproduced 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. Papanek

4 (3-6) 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 331,332 Materials and Processes

PD 401, 402 Advanced Product Design

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 Mr. Macomber and sketches.

PD 422 Office and Industrial Practice

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

Prerequisite: PSY 200

Required of fourth year students in Product Design

Seminar on imaginative problem solving. Individual and group operational techniques in the Mr. Papanek spectrum of creative thought.

PD 501 Advanced Product Design

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. Mr. Papanek

PD 502 Product Design Thesis

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 development of functional contribution, including complete programming of manufacture and distribution systems appropriate to the design.

Mr. Papanek

Psychology

(See Education)

366 THE GENERAL CATALOG

3 (3-0) f s

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7

6 (3-12) f s

2 (2-0) s

2 (2-0) f s

8 (3-12) f

9 (3-18) s

Recreation and Park Administration

(See Education)

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

^{*} Additional courses, suitable for rural sociology majors and graduate 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 301 Sociology of Rural Life

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

Introduction to Social Research RS 321

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 Messrs. Young and Mayo are stressed throughout the course.

RS 322 Introduction to Rural Social Work

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

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

Prerequisite: RS 301 or permission of the instructor

Social structure is viewed in its two major dimensions: (1) vertically through the concepts of social stratification; and (2) horizontally as a set of basic social institutions interacting by means of a system of concrete social organizations. Particular attention is given to the place of the rural segment in the total social system. The bases of social cohesion which permit diversity within a functioning whole are examined. Mr. McCann

* Courses for Graduates and Advanced Undergraduates

RS 511 Rural Population Problems

Prerequisite: RS 301

3 (3-0) f s

3 (3-0) f s

3 (3-0) s

3 (3-0) f

3 (3-0) s

3 (3-0) f

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

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 Mr. Hamilton and methods of study.

RS 513 Community Organization

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

3 (3-0) s

3 (3-0) f

^{*} See footnote on page 366.

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 agricultural land tenure systems of the world with major emphasis on the problems of family farm ownership and tenancy in the United States. Mr. Hamilton

RS 534 (HI 534) Farmers' Movements

Prerequisite: Three hours of Sociology

A history of agricultural organizations and movements in the United States and Canada principally since 1865, emphasizing the Grange, the Farmers' Alliance, the Populist Revolt, the Farmers' Union, the Farm Bureau, the Equity societies, the Non-partisan League, cooperative marketing, government programs and present problems. Mr. Noblin

RS 541 Social Agencies and Programs

Prerequisite: Three 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

Research Methods in Sociology RS 611

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**

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

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

3 (3-0) f

3 (3-0) s

3 (3-0) s

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3 (3-0) f

RS 632 Rural Family

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 Mr. Hamilton family stability and effectiveness.

RS 633 The Rural Community

Prerequisite: Permission of the 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

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

3 (3-0) s

3 (3-0) f

3 (3-0) s

RS 642 Research in Rural Sociology

Prerequisite: Permission of chairman of graduate study committee. Planning and execution of research, and preparation of manuscript under supervision of graduate committee.

RS 653 Theory and Development of Rural Sociology

Prerequisite: Permission of the instructor

Required of all master's and doctoral candidates in Rural Sociology and recommended for all graduate minors. Designed to meet two objectives: (1) to introduce the student to the sudy of current sociological theory and (2) to survey events and trends in the historical development of rural sociology. Mr. Hamilton

RS 671 Seminar

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 Science and Civilization

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

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.

3 (3-0) f s

3 (3-0) f s

Credits by arrangement

(Maximum of six credits)

Credits by arrangement

3 (3-0) s

Sociology

(Also see Anthropology)

Courses for Undergraduates

SOC 202 Principles of Sociology

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.

Public Relations and Modern Society SOC 302 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.

3 (3-0) f s

SOC 303 Current Social Problems 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

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

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

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.

Human Relations in Industrial Society SOC 401

Prerequisite: Senior standing or permission of instructor 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

Prerequisites: SOC 202 and permission of instructor

A study of the factors in the growth of cities; the relationship between 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

Prerequisites: SOC 202 and permission of instructor

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

Prerequisites: SOC 202 and permission of instructor

A course designed to acquaint studente 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.

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3 (3-0) f s

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3 (3-0) f s

SOC 414 Social Structure

Prerequisites: Six hours in Sociology and permission of instructor 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

Prerequisites: Nine hours in Sociology and permission of instructor 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

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, scientific and executive leadership problems.

3 (3-0) f s

3 (3-0) f s

3 (3-0) f s

SOC 502 Society, Culture, and Personality

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

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

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

Prerequisites: Nine semester hours in 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

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.

Soil Science

3 (3-0) f s

3 (3-0) f s

Courses for Undergraduates

SSC 200 Soils Prerequisite: CH 103 or CH 107. 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

SSC 302 Soils and Plant Growth

Prerequisites: SSC 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.

4 (3-3) s

SSC 341 Soil Fertility and Fertilizers

Prerequisites: SSC 200, BO 103

History of plant nutrition and soil fertility. Plant nutrition and growth as related to crop fertilization. Fertilizer materials, their manufacture, properties and usage. Fertilizer practices as related to a sound soil management program. Mr. Younts

SSC 452 Soil Classification

Prerequisite: SSC 200

The processes involved in the origin of soil and its properties are explained. Logical schemes of soil classification and soil management are developed based upon soil profile properties as operational criteria. The laboratories and field trips are designed to teach the student how to recognize certain soil profile properties and inferences which may be drawn from them.

Mr. Cooke

3 (3-0) f

Soil Conservation and Management SSC 461

Prerequisite: SSC 200 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 Mr. Lutz maintenance.

SSC 480 Senior Seminar

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

SSC 511 Soil Physics

Prerequisites: SSC 200 and PY 212

Physical constitution and analyses; soil structure, soil water, soil air and soil temperature in relation to plant growth. Mr. Lutz

SSC 522 Soil Chemistry

Prerequisites: SSC 200, SSC 553 and CH 433 or permission of instructor.

A consideration of the chemical and colloidal properties of clay and soil systems, including ion exchange and retention, soil solution reactions, solvation of clays, and electrokinetic pro-

1 (1-0) f s

3 (3-0) f

3 (2-3) s

4 (3-3) f

4 (3-3) s

perties of clay-water systems.	· · · · · ·
(Offered in 1964 and alternate years thereafter)	Mr. Weed
SSC 524 Mass Spectrometry Prerequisites: SSC 202 and CH 422 or permission of instructor	2 (1-3) s
An examination of theoretical and analytical aspects of mass spectrome	try and stable isotopic
(Offered in 1963 and alternate years thereafter)	Mr. Volk
SSC 532 Soil Microbiology Prerequisites: SSC 302, BO 312 and CH 220	3 (3-0) s
The more important microbiological processes that occur in soils; dec materials, ammonification, nitrification, and nitrogen fixation.	composition of organic
(Offered in 1963 and alternate years thereafter)	Mr. Bartholomew
SSC 541 Soil Fertility Prerequisites: SSC 302 and SSC 341	3 (3-0)
Soll conditions affecting plant growth and the chemistry of soll and ferti	inzer interretationships.

Factors affecting the availability of nutrients. Methods for measuring nutrient availability. Mr. Kamprath

SSC 551 Soil Morphology, Genesis and Classification

Prerequisites: SSC 200, SSC 302, or SSC 341 and 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 processess. 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.

(Offered in 1962 and alternate years thereafter)

SSC 553 Soil Mineralogy

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Prerequisites: SSC 200, SSC 341 and MIG 330 or permission of instructor

Composition, structure, classification, identification, origin, occurrence, and significance of soil minerals with emphasis on primary weatherable silicates, layer silicate clays, and sesquioxides. Messrs. McCracken and Weed

North Carolina Soils and Their Management SSC 560

Prerequisites: SSC 200, SSC 302 or SSC 341

Field studies of selected soil series in the Coastal Plain, Piedmont and Mountain areas of North Carolina. Discussion of management practices that should be associated with the various soils under different types of farming.

(Offered in Summer 1963 and alternate years thereafter). Messrs. McCracken, Fitts and Spain

SSC 570 Special Problems

Prerequisites: SSC 200 and SSC 302

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 Graduate Students Only

SSC 622 Physical and Chemical Properties of Soils

Prerequisites: SSC 511, SSC 522, CH 433, MA 301 or permission of instructor

An examination in depth of current ideas concerning the physics and chemistry of soil and clay systems. Topics will include ion exchange, molecular adsorption, electrokinetics, relations between mineral structures and their physical and chemical properties, and the properties of

adsorbed water. Emphasis will be determined by student interest and by current literature. (Offered in 1963 and alternate years thereafter). Messrs. Miller and Weed

SSC 651 Pedology

Prerequisites: SSC 522 and SSC 511

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 1964 and alternate years thereafter). Mr. McCracken

3 (Summer)

Credits by arrangement.

2 or 3-0 (By arrangement)

0-4

(3-0)

Mr. McCracken

3 (2-3) f

SSC 672 Soil Properties and Plant Development

Prerequisites: CH 551, SSC 522 or equivalents

A detailed examination of the effects of soil factors in the development of crop plants. Segments of the course will treat (1) soil transformation processes of both organic and inorganic constituents, (2) concepts of nutrient availability and (3) the relation of plant development indices to specific soil properties.

(Offered in 1964 and alternate years thereafter).

SSC 680 Seminar

Prerequisite: Graduate standing in Soil Science

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 Graduate Staff the doctorate.

Messrs. Jackson, Bartholomew and Davey

1(1-0) f s

0-4

SSC 690 Research

Prerequisite: Graduate standing in Soil Science

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 221 Fundamentals of Textiles

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. Two 1-hour lectures and one 2-hour laboratory period per week. Messrs. Lassiter, Moser

TX 261 Fabric Structure

Prerequisite: TX 221

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

Required of students in Furniture Manufacturing

Textile students may not take this course for degree credit.

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. Moser

Credits by arrangement

3 (2-2) f s

3 (2-2) f s

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2 (2-0) s

TX 281 Fiber Quality

Prerequisite: TX 221

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 303 Fiber and Yarn Technology

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

4 (3-2) f s

3 (2-2) f s

TX 304 Fiber and Yarn Technology

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

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

TX 365 Fabric Technology

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. Berry, Porter

TX 366 Fabric Technology

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

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.

4 (3-2) f s

4 (3-2) f s

4 (3-2) f s

4 (3-2) f s

3(2-2) f s

TX 436 Staple Fiber Processing

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 silver 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

Prerequisite: TX 366

Required of students in Fabric Technology

Elective for others

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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 2hour laboratory period per week. Messrs. Porter, Berry

3 (2-2) f s

3 (2-2) f s

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TX 485 Mill Design and Organization

Prerequisites: TX 303, TX 365

Required of students in the Textile Technology curriculum. Beginning in the 1963 fall semester, for seniors in final semester only

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.

TX 490 Development Project I

Prerequisites: 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

Prerequisites: TX 281 and TX 221

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. Li, Middleton

TX 441 Flat Knitting

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

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

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3 (2-2) f s

2 (2-0) f s

3 (2-2) s

1 (0-2) f s

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TX 444 Garment Manufacture

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.

TX 447, 448 Advanced Knitting Laboratory

Prerequisite: TX 342 Required of seniors in Knitting Technology Elective for others Systematic study of circular hosiery mechanisms: hosiery types at

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. Messrs. Li, Shinn

3 (2-2) s

2 (0-4) f s

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Textiles 377

TX 449 Tricot Knitting

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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.

TX 483 Textile Cost Methods

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. Lynch, Middleton, Shinn

Textile Chemistry

TC 201 Textile Chemistry I

Prerequisites: CH 103, TX 281

Required of juniors in Textile Technology

A comprehensive course designed to familiarize the student with the chemical properties of all natural and man-made fibers; some emphasis is placed upon the relationship between molecular structure and physical properties; the principles and methods for producing manmade fibers are discussed; a brief survey of organic chemistry is included, particularly those parts that relate to polymer chemistry. Two one-hour lectures per week. Mr. Rutherford

TC 303, 304 Textile Chemistry III

Prerequisites: CH 221, CH 223

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

Prerequisite: TC 201

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.

3 (2-2) s

2 (2-0) f s

2 (2-0) f s

3 (2-3) f s

4 (3-2) f s

TC 403, 404 Textile Chemical Technology

3 (3-0) f s

Prerequisites: TC 304, CH 223

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 per week.

TC 405, 406Textile Chemical Technology Laboratory2 (0-6) f sRequired of seniors in Textile ChemistryTo be taken concurrently with TC 403, 404. Two 3-hour laboratories per week.

TC 411 Textile Chemical Analysis I

Prerequisite: CH 215

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, Cates, Rutherford

TC 412 Textile Chemical Analysis II

Prerequisites: CH 215, TC 304

Required of 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, Cates, Rutherford

TC 421 Fabric Finishing I

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, including stabilization finishes, water repellency, crease resistance, moth and mildew proofing, fire-proofing, etc. Emphasis on chemistry of finishes varied to fit requirements of students. Two 1-hour lectures per week.

Mr. Hayes

Courses for Advanced Undergraduates and Graduates

Textile Technology

TX 501 Textile Technology Seminar

Prerequisites: 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.

TX 521 Textile Testing II Prerequisite: TX 327 Elective 3 (1-6) f s

2 (2-0) f s

3 (1-6) f s

2 (2-0) s

3 (2-3) f

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

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

Prerequisites: 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

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Textiles 379

TX 525 Advanced Textile Microscopy

Prerequisite: TX 327 Elective

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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 photomicrographic equipment. Lectures and laboratory arranged.

TX 551 Complex Woven Structures

Prerequisites: TX 303, TX 478 Elective

The development of design specifications for complex fabrics as related to fabric geometry, functional and aesthetic properties and manufacturing limitations. Three 1-hour lectures and one 2-hour laboratory per week. Mr. Berry

TX 575 Fabric Analytics and Characteristics

Prerequisite: TX 365 or TX 366 or TC 511

Required of students in Fabric Technology

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. Porter

General Textile Course

TX 581 Instrumentation and Control

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, pressure, flow and liquid level, the application of control apparatus to chemical processes and physical finishing of textile products. Two 1-hour lectures and one 2-hour laboratory period per week.

Textile Chemistry

TC 501 Seminar in Textile Chemistry

2 (arranged) f s

4 (3-2) s

3 (3-0) f s

3 (2-2) f s

Prerequisite: TC 403

Required of seniors in Textile Chemistry

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

Prerequisite: CH 223

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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 man-made fibers; the nature of the chemical reactions which produce degradation of fibers; the production of man-made fibers. Three 1-hour lectures per week. Mr. Rutherford

TC 512 (CH 512) Chemistry of High Polymers3 (3-0) f sPrerequisite: CH 431Elective for Textile Chemistry students

Mechanisms and kinetics of polymerization; molecular weight description; theory of polymer solutions. Three 1-hour lectures per week. Mr. Cates

3 (3-0) f

TC 521 Textile Chemical Analysis III

Prerequisite: TC 421 or permission of instructor Elective for students in Textile Technology.

No credit allowed for students majoring in Textile Chemistry.

The work includes a survey of organic chemistry, with emphasis on organic surfactants, warp sizes, and fabric finishes of all types; the identification of fibers by chemical means; the qualitative and quantitative analysis of fiber blends by chemical means; the identification of finishes; the evaluation techniques for dyed and finished materials. Two one-hour lectures and one three-hour laboratory period per week. Graduate Staff

Courses for Graduates Only

TX 601, 602 Yarn Technology

Prerequisite: Graduate standing

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

Prerequisite: TX 522 or equivalent

Design of textile laboratories, including conditioning equipment and instruments required for specific needs; performance of tests and analysis of data on industrial problems; specialized physical tests; inter-laboratory tests and analysis; study of A.S.T.M. specifications and work on task groups for the A.S.T.M. Society. One 1-hour lecture and one 2-hour laboratory period per week. Mr. Hamby

TX 631 Synthetic Fibers

Prerequisite: TX 430 or TX 436 or equivalent

Lectures and projects on advanced problems relative to the properties and processing of manmade continuous filament and staple fiber yarns. Messrs. Grover, Hamby

TX 641, 642 Advanced Knitting Systems and Mechanisms 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

3 (arranged) f s

3 (arranged) f s

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Graduate Staff

TX 643, 644 Knitting Technology Prerequisites: Graduate standing and 8 credits in Knitting Technology	3 (2-2) f s
Problems of specific interest to the knitting industry will be assigned for gation. The use of experimental methods will be emphasized. Attention	study and investi- will be given to
the preparation of reports for publication.	Graduate Staff
TX 651, 652 Fabric Development and Construction Prerequisite: Graduate standing	3 (arranged) f s
Application of advanced technology to the development and construction	of woven fabrics. Mr. Porter
TX 681 Textile Research Problems of specific interest to the textile industry will be assigned for gation. The use of experimental methods will be emphasized. Attention w preparation of reports for publication. The master's thesis may be bas obtained.	lits by arrangement study and investi- ill be given to the ed upon the data Graduate Staff
TX 683 Seminar Discussion of current scientific publications of interest to the textile ind discussion of student papers and research problems.	1 (1-0) f s dustry; review and Graduate Staff

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ZO 213 Human Physiology Prerequisite: ZO 103

ZO 212 Human Anatomy

Prerequisite: ZO 103

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3 (arranged) f s

TC 605 Physical Chemistry of Dyeing

Prerequisite: CH 433

Development of principles of thermodynamics, emphasizing applications in dye and fiber chemistry. Mr. Cates

TC 606 Chemistry of Fiber-Forming High Polymers

Prerequisite: CH 433

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

ZO 206 Vertebrate Zoology

Prerequisite: ZO 103 or equivalent

and student projects and reports.

Prerequisite: ZO 103

The biology and classification of the invertebrate animals with special reference to the forms commonly encountered and those which illustrated zoological principles.

The biology, classification, behavior, and natural history of fishes, amphibians, reptiles, birds, and mammals, including laboratory identification of representative forms, local field trips,

A study of human anatomy with major emphasis on the structure and function of the

muscular, skeletal, circulatory and nervous systems. Required of majors in recreation.

Mr. Miller

4 (3-3) s

3 (2-2) f

Mr. Quay

Staff

3 (3-0) s

3 (arranged) f s

4 (3-3) f

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. Staff

ZO 223 Comparative Anatomy

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

Prerequisites: ZO 103, PY 215 and CH 221 Physiology of vertebrates with particular reference to man and the lower animals. Mr. Santolucito

ZO 312 Principles of Game Management

Prerequisites: 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

4 (3-3) f s

3 (3-0) s

4 (2-4) f s

ZO 315 Animal Parasitology

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 Mr. Harkema and poultry are covered.

ZO 321 Wildlife and Natural Resources Conservation

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 overexploitation on primitive and civilized societies. Emphasis is placed on the renewable re-Mr. Barkalow sources, particularly wildlife.

Courses for Graduates and Advanced Undergraduates

ZO 501 Ornithology

Prerequisite: ZO 103

The biology and classification 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 Mr. Quay research projects on nesting populations.

ZO 513 Comparative Animal Physiology

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

Prerequisites: ZO 103 and 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**

Prerequisite: ZO 520

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

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Mr. Hassler

ZO 522 Animal Ecology

Prerequisites: ZO 103 and BO 103

The general principles of the inter-relations among animals and between animals and their environments-land, freshwater, marine. Mr. Quay

3 (1-4) s ZO 541 Cold-blooded Vertebrates (Ichthyology) 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 Mr. Hassler class.

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 Mr. Hassler with the needs and interests of the class.

3 (2-3) f

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ZO 544 Mommology Prerequisites: ZO 103, ZO 206, and approval of instructor The classification, identification, and ecology of the major mammalian groups.	3 (1-4) f	
	Mr. Barkalow	
ZO 545 Histology Prerequisite: ZO 108	4 (2-4) f	
The microscopic anatomy of animal tissues.	Mr. Roberts	
ZO 551, 552 Wildlife Science Prerequisite: ZO 206	3 (2-3) f s	
The principles of wildlife management and their application are studied in and in the field.	the laboratory Mr. Hester	
ZO 561 Animal Embryology Propaguisita: ZO 102	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 science, poultry science, and zoology. Mr. Alliston		
ZO 571 Special Studies Credits b	y Arrangemen t	
A directed individual investigation of a particular problem in zoology, acco review of the pertinent literature. A maximum of three credits allowed toward degree, six toward the master's degree and nine toward the doctorate.	mpanied by a the bachelor's Graduate Staff	
ZO 581 Parasitology 1 Prerequisites: ZO 103 and 223	4 (2-4) s	
The study of the morphology, biology, and control of the parasitic protozoa of man, domestic and wild animals.	and helminths	
(Offered in fall semester 1963)	Mr. Harkema	

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ZO 582 (ENT 582) Medical Entomology

Prerequisite: ENT 301 or 312

A study of the morphology, biology and control of the parasitic arthropods of man, domestic

and wild animals. (Offered in spring semester 1962)

Messrs. Harkema and Farrier

ZOOLOGY

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Courses for Graduates Only

ZO 603 Advanced Parasitology 3 (2-3) s Prerequisites: ZO 591 and 592 The study of the theoretical and practical aspects of parasitism; taxonomy, physiology, and immunology of animal parasites. Mr. Harkema

ZO 614 Cell Physiology

Prerequisites: ZO 103, and approval of the instructor

A study of those fundamental physiological properties at the cellular level which are common to nearly all organisms. Lectures, discussions, and critical reports (oral and written) to promote aquaintance with general literature and recent advances. Mr. Santolucito

3 (3-0) s

3 (2-3) s

ZO 622 Seminar

The presentation and defense of current literature papers dealing with the findings of original research or with fundamental biological concepts. Graduate Staff

ZO 627 Zoogeography

Prerequisites: ZO 522, and approval of instructor. The geographic distribution of animals, with primary emphasis on land and freshwater ਼ਬ ਨੇ ਕੁਝ ਤ Mr. Quay vertebrates.

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ZO 641 Research in Zoology

Prerequisites: Twelve semester credits in Zoology, and approval of the instructor Problems in development, life history, morphology, physiology, ecology, game management, taxonomy, or parasitology. A maximum of six credits is allowed toward the master's degree, but any number toward the doctorate. Graduate Staff

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ADMINISTRATION AND FACULTY

The Alumni Association

H. W. TAYLOR, Director of Alumni Affairs

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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

The Alumni Fund was established by the Alumni Association at State College in 1952 to replace the old dues paying program and provide a means through which the alumni may contribute to the advancement of the College. Each alumnus is invited to make an annual contribution.

State College News

State College News is published every month in the year by the Alumni Association and sent to contributors to the Alumni Fund. The purpose of the magazine is to keep association members in touch with the College and with each other. It carries news and pictures of students and former 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 Alumni Memorial Building (formerly the Old Infirmary Building), is official headquarters for alumni when they visit the campus.

College Foundations

L. L. RAY, Director

Nine foundations, organized and incorporated under the laws of North Carolina, promote and support various State College programs.

The foundations include the North Carolina State College Foundation, Inc., the North Carolina Agricultural Foundation, Inc., the North Carolina Dairy Foundation, Inc., the North Carolina Engineering Foundation, Inc., the North Carolina Textile Foundation, Inc., the North Carolina Design Foundation, Inc., the North Carolina Forestry Foundation, the Pulp and Paper Foundation, Inc., and the 4-H Development Fund, Inc.

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State College Foundation

The North Carolina State College Foundation, Inc., was organized 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.

Agricultural Foundation

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.

Dairy Foundation

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 60 persons handles the affairs of the Foundation; these directors represent distributors, producers, and jobbers.

Engineering Foundation

The North Carolina Engineering Foundation, Inc., gives financial assistance to teaching, research, and extension in and through the School of Engineering.

Textile Foundation

The North Carolina Textile Foundation, Inc., was formed to promote the development of the School of Textiles, and was incorporated December 31, 1942. Funds for this foundation have been raised largely from textile manufacturing plants and other corporations and industries closely allied to textiles.

Design Foundation

The North Carolina Design Foundation, Inc., was organized January, 1949. Foundation funds are used for the promotion and advancement of architectural education at North Carolina State College.

Forestry Foundation

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

The 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.

4-H Development Fund

The 4-H Development Fund, Inc., was organized in 1959. 4-H Development Fund monies are used to promote and advance all areas of 4-H Club work in North Carolina.

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Wake Ashe Chatham New Hanover Hertford Lincoln Cherokee Forsyth Greene Nash Yancey Harnett Iones Brunswick Buncombe Cumberland Randolph Moore Johnston Mecklenburg Guilford Hoke Guilford Franklin

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By action of the Trustees, the General Faculty includes all members of the College's teaching force above the rank of Instructor and all general administrative offices of the institution. In the President of the Consolidated University, the Chancellor of the College, and the General Faculty is vested final authority (under the Trustees) over all matters of College policy and activity. Under the General Faculty and Administrative Council, the Schools have separate Faculties and Administrative Boards (composed of all Department Heads) which have final authority over matters pertaining solely to their respective Schools, when not in conflict with Consolidated University and College regulations.

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