1951

Clemson Graduate School Catalog, 1950-1951

Clemson University

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Recommended Citation
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ANNOUNCEMENTS OF
THE GRADUATE SCHOOL
FOR
1950 - 1951
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213063
COLLEGE CALENDAR

SUMMER TERM 1950

Matriculation and Registration ............................. June 12
Classes begin ............................................... June 13
Independence Day holidays ......................... July 3, 4
Examinations ........................................... August 9-11

SESSION 1950-1951

Matriculation, new students ............................ September 4
Registration, new students ............................... September 6
Matriculation and Registration, former students ........................ September 7, 8
Classes begin ............................................ September 11
State Fair holidays begin at 1 p.m. ................. October 18
State Fair holidays end at 10 p.m. ................ October 22
Thanksgiving holidays begin at 1 p.m. ............. November 22
Thanksgiving holidays end at 10 p.m. .............. November 26
Christmas holidays begin at 12 noon ................. December 20
Christmas holidays end at 10 p.m. ................. January 2
End of First Semester ................................ January 27
Mid-Year Graduating Exercises ......................... January 28
Matriculation, new students ............................. January 29
Registration, new students ............................. January 31
Matriculation and Registration, former students ........................ February 1, 2
Classes begin ............................................ February 5
Easter holidays begin at 12 noon ................. March 22
Easter holidays end at 10 p.m. ...................... March 26
Commencement ............................................. June 3
SUMMER TERM 1951

Matriculation and Registration ____________ _______ June 12
Classes begin ___________________________ June 13
Independence Day holiday __________________ July 4
Examinations _____________________________ August 8-10

SESSION 1951-1952

Matriculation, new students _________________ September 3
Registration, new students __________________ September 6
Matriculation and Registration, former students __ Sept. 6, 7
Classes begin _____________________________ September 10
State Fair holidays begin at 12 noon __________ October 24
State Fair holidays end at 10 p.m. _____________ October 28
Thanksgiving holidays begin at 1 p.m. __________ November 21
Thanksgiving holidays end at 10 p.m. __________ November 25
Christmas holidays begin at 12 noon __________ December 20
Christmas holidays end at 10 p.m. _____________ January 2
End of First Semester _______________________ January 26
Matriculation, new students _________________ January 29
Registration, new students __________________ January 31
Matriculation and Registration, former students ___________ Jan. 31, Feb. 1
Classes begin ________________________________ February 4
Easter holidays begin at 12 noon _______________ April 10
Easter holidays end at 10 p.m. _________________ April 14
Commencement _______________________________ June 1
PERSONNEL

OFFICERS OF ADMINISTRATION

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President

Andrew Joseph Brown, B.S.
Treasurer and Secretary of Board of Trustees

James Corcoran Littlejohn, B.S.
Business Manager

Lee W. Milford, M.D.
Surgeon

Gustave Ernest Metz, B.S., M.A.
Registrar

Cornelia Ayer Graham, B.S.
Librarian

Herbert Press Cooper, Ph.D.
Dean, School of Agriculture

Francis Marion Kinard, A.B., A.M., Litt.D.
Dean, School of Arts and Sciences

Howard Louis Hunter, Ph.D.
Dean, School of Chemistry

William Harold Washington, B.S., M.S.
Dean, School of Education

James Hagood Sams, Jr., Ph.D.
Acting-Dean, School of Engineering

Hugh Monroe Brown, Ph.D.
Dean, School of Textiles

GRADUATE COMMITTEE

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Charles Homer Arndt
George Hubert Aull
Hugh Monroe Brown
Peter Carodemos
Gilbeart Hooper Collings
John Murphy Cook
Edwin Jones Freeman
Howard Emmitt Glenn

Joseph Coleman Green
Lorenz Ditmar Huff
Howard Louis Hunter
Willis Alonzo King
James Hagood Sams, Jr.
Frank Bonnell Schirmer, Jr.
Rupert Taylor
Thomas Arlington White
INFORMATION

GENERAL INFORMATION

Clemson is a land-grant college, a state institution, and one of the A. and M. colleges which emphasizes agriculture and mechanical industries. Clemson is fully accredited by the Southern Association of Colleges and Secondary Schools.

The twenty-eight curricula under the Schools of Agriculture, Arts, and Sciences, Chemistry, Education, Engineering, and Textiles form a background of training for the hundreds of occupations in which Clemson graduates engage. In addition to the training for a specific occupation, each curriculum is broadened to include fundamental training in the occupational area as well as the worthwhile values of general education. Although the College is organized on the university plan of various schools, it retains its entity through the interrelationships of schools and departments in providing a well-balanced educational program.

It is the primary purpose of the Graduate School to provide opportunities for comprehensive training in special fields, to instruct the student in methods of independent investigation and to foster the spirit of scholarship and research. It is the intention to reduce the routine requirements to a minimum. So far as they exist they are for the purpose of furnishing the discipline and methods for independent study and investigation. Courses of study, association with older investigators and other aids and methods are for the promotion of productive scholarship.

EXPENSES

The cost to South Carolina students for board, laundry, dormitory room, all fees and tuition will amount to $531.00 for the 1950-1951 session. Students from other states pay an additional $170.00. Thus, regular South Carolina students will make payments of $265.50 per semester for room, board, laundry, all fees and tuition. In like manner, non-resident students will make payments of $350.50 per semester. South Carolina students living at home and not using the college laundry will make payments of $92.30 per semester to the college for tuition and fees.
Veterans. For veterans qualified for benefits under the G.I. Bill or Veterans' Vocational Rehabilitation, the Veterans Administration pays tuition, fees and the cost of necessary books and supplies. The veteran pays his own living expenses but the subsistence checks to be received by the veteran will more than reimburse him for the cost of living in the barracks at Clemson. Qualified veterans living in the college dormitories will make payments of $173.20 per semester to the college for room, board, and laundry.

Books and Supplies. The cost of books is not included in the figures given above. For veterans, qualified for benefits under the G.I. Bill or Veterans' Vocational Rehabilitation, books and educational supplies will be issued, the cost to be paid by the Veterans Administration.

BUILDINGS AND GROUNDS

Buildings. Tillman Hall houses the offices of the President, the Registrar, the Commandant, the Treasurer, the Business Manager, the Professor of Military Science and Tactics, and the Dean of the School of Arts and Sciences. This building also has over twenty classrooms. At the north end of the building is Memorial Hall, the College Auditorium, with a seating capacity of about eighteen hundred.

The Library Building, located in approximately the center of the campus, houses the Main Library, the Agricultural Reference Department, the Museum, the Recreational Reading Room, Radio Room and the Music Room. The Social Science Department uses four class rooms on the second floor, and the Mailing Room for the Experiment Station and Extension Departments is on the basement floor.

The instructional work of the institution is maintained largely in the departmental buildings. The Schools of Agriculture, Engineering, Textiles, Education, and Chemistry have individual buildings especially designed for their purposes. The School of Arts and Sciences is located in the Administration Building with additional classrooms in the Library and the Physics Building. Certain laboratory work is
conducted at the greenhouses, livestock barns, poultry plant, veterinary hospital, and other buildings on the college farm.

New buildings to be completed in 1951 will give the School of Chemistry and the Department of Agricultural Engineering greatly expanded and improved teaching facilities.

Fort Hill, the former home of John C. Calhoun, is located on the Clemson campus. In accordance with the provisions of Mr. Clemson's will, this residence has been made a shrine in honor of Mr. Calhoun. Several pieces of furniture and other interesting relics, formerly the property of Mr. Calhoun, are carefully preserved in this home, where they may be seen by visitors to the college.

**Grounds.** The college grounds comprise about 1,645 acres, including the campus, the farm, and the Experiment Station grounds. The two-hundred acre campus is laid out in walks, drives, and lawns, and is shaded by a beautiful grove of native forest trees.

**HOUSING FACILITIES**

The student dormitories consist of nine large brick buildings five of which were constructed since 1935, and two wooden structures erected during 1946. All barracks are steam-heated, electrically lighted, and supplied with hot and cold water. The barracks rooms are equipped with single width beds and other necessary equipment. Students not participating in the R.O.T.C. are housed in similar dormitories apart from the cadet corps.

The dining hall is located in one of the barracks and is under the supervision of an experienced staff. All students living in the dormitories eat in the dining hall.

**Family Housing.** Information concerning family housing facilities at Clemson may be obtained by writing the Housing Office, Clemson Agricultural College, Clemson, South Carolina.

Three hundred and ninety-eight houses for married veteran students are provided. These houses are equipped with space heater, cooking range, hot water heater, and ice box.
LIBRARY FACILITIES

The Library contains 120,107 bound volumes, consisting of books, periodicals and U. S. Government Publications. In addition to the bound volumes the Library contains 769,170 unbound Federal, State, Experiment Station and Extension Service publications; 7,276 unbound periodicals and 87,444 pamphlets and clippings in the vertical subject file.

The Recreational Reading Room is located in the basement of the Library Building, is beautifully and comfortably furnished, and contains many popular and attractive books, current magazines, and daily newspapers.

The Music Room, also located on the basement floor, contains a Carnegie Collection of 1,271 recordings of classical and semi-classical music, an RCA record player, along with music scores and other books relating to music.

The Library Staff consists of nine professionally trained Librarians and several other non-professional assistants and clerical workers. A trained Librarian is always on duty to assist faculty and students.

The Library is open daily from 8 a.m. until 10 p.m., Monday through Friday, from 8 a.m. to 5:30 p.m. Saturdays, and from 2 p.m. to 10 p.m. Sundays, with the exception of holidays.

STUDENT HEALTH SERVICE

The Surgeon, who has complete charge of the hospital, is one of the regular officers of the College, and his special duty is to look after the health of the students.

At a specified time every day, students who desire may consult the Surgeon, and those who are admitted to the hospital are cared for by experienced nurses in the college hospital. In case of necessity students are allowed to consult the Surgeon at any time, or send for him in an emergency.

The Surgeon cannot undertake to notify parents every time a student reports to the hospital for medicine, or for rest on account of some slight complaint. However, they
may rest assured that they will be notified at once of sickness of any consequence.

The medical fee paid by each student is intended to cover all ordinary cases of sickness and their treatment. It is not intended to cover fees of doctors or specialists called into consultation, for performing operations, for special nurses, or for any medical or surgical attentions performed away from the College; and the College does not assume any responsibility for accidents that happen away from the College. Such expenses must be borne by the parents. The right of the College Surgeon, with the approval of the President of the College, to incur in behalf of any student under his care any of these extra services is hereby expressly reserved.

ORGANIZATION AND GOVERNMENT
ADMINISTRATIVE ORGANIZATION

Board of Trustees. The government of the College is vested in a Board of thirteen members, six of whom are elected by the Legislature, and seven life and self-perpetuating under the Clemson will. The function of this Board is legislative and not executive. The Board determines the general policy of the College, makes the laws for its government, and directs the expenditure of its funds.

The President is the chief executive and administrative officer appointed by the Board of Trustees. He is the head of the College and is responsible for its satisfactory working and success.

The College is divided into schools of Agriculture, Arts and Sciences, Chemistry, Education, Engineering, and Textiles. A dean is at the head of each school and is responsible to the President for its conduct and success. The schools are comprised of departments. Each department is in charge of a professor who acts as its head. The President conducts all official business with each department through its dean.
The Graduate School is under the direction of the Committee on Graduate Studies. The Chairman of this Committee is the administrative officer of the School. Inquiries about admission should be addressed to The Director of Admissions, Box 72, Clemson, South Carolina. Inquiries about assistantships and facilities for advanced study and research should be addressed to the Department in which such work is to be done.

No effort has been made to set up a graduate faculty as such. Those who teach courses for which graduate credit is given are considered members of the graduate faculty although they do not function as a distinct body.

DEGREES AND CURRICULA
REQUIREMENTS AND REGULATIONS

Courses and Degrees. Courses are offered leading to the degree of Master of Science, Master of Mechanical Engineering, Master of Electrical Engineering, and Master of Civil Engineering.

The College also offers the following professional engineering degrees: Civil Engineer, Electrical Engineer and Mechanical Engineer. The requirements for these degrees are: (a) a Bachelor's degree from Clemson College in one of these three branches in engineering, (b) five years of subsequent professional experience, one year of which must have been in responsible charge of engineering or engineering instruction, (c) the preparation of a thesis demonstrating distinct technical ability. (Detailed information regarding professional degrees may be obtained from the Registrar.)

A list of major fields and courses acceptable for graduate credit is listed elsewhere in this bulletin. Those fields in which less than twelve semester credits of the 500 series are listed are not acceptable as major fields of study. Since new graduate courses are being added constantly persons inter-
ested in pursuing work in a field which does not list 12 or more credits in the major field should inquire of the department concerned for further information. Certain courses of the 300 and 400 series are acceptable for graduate credit under conditions outlined under "course work required." The name and catalog number of these 300 and 400 courses are listed in this bulletin. Complete descriptions of these courses can be found in the General Catalog which may be obtained from the Registrar.

Admission. Before admittance to the Graduate School a student must have the Bachelor's degree from an institution with a scholastic rating satisfactory to the college, and must have the approval of the Head of the Department in which he plans to do his major work. For unconditional admission to the Graduate School the applicant must have an average undergraduate grade of B or better in the major field. If the previous scholastic training is not considered adequate, the student may be required to make good the deficiency by doing additional supplementary work and lengthening the time required to obtain the degree.

With the approval of their Dean or Director, qualified, full time employees of The Clemson Agricultural College may pursue graduate work for credit. Members of the faculty, experiment station or extension service staff or other staff members having a rank higher than Instructor or its equivalent, may not, however, be considered as candidates for advanced degrees at this Institution.

Students desiring to enroll in the Graduate School must make application to the Director of Admissions. The application should be accompanied by a transcript of previous college work, and by such written recommendations as are necessary in support of the application. Within one month after registering for graduate credit the student must file with the chairman of the Graduate Committee his Preliminary Plan of Graduate Study, G.S. Form 2. Admission to the Graduate School does not automatically qualify a student as a candidate for an advanced degree. A written application for the degree must be presented to the Chairman
of the Graduate Committee at least three months before the convocation in which the degree is expected. This application must list the major and minor subjects to be offered for the degree and must be accompanied by the outline of a proposed thesis. It must bear the signed approval of the heads of the departments and the professors concerned.

**Degree Requirements.** To receive the Master's degree the student must spend the equivalent of at least one academic year in residence at the College as a graduate student. No graduate credit will be allowed for courses completed in less than six weeks. The Master's degree must be obtained within a six year period.

In addition to such supplementary or supporting courses as may be required, the work will consist of a minimum of 30 semester hours of which six semester hours shall be research, on the basis of which a thesis is required. Of the remaining 24 semester hours, at least 12 hours must come from the courses numbered 500 or above. The additional credit hours (the minor or minors) are to be determined in consultation with the professors in charge of the work which is to require the major and minor interests of the student. Of the 24 course hours required, at least 12 hours must be in the major field and at least 6 hours in one minor. To receive credit for a course numbered less than 500 the student must attain a grade of B or better. Credit may be received for a grade of C on 500 series courses, provided, however, that the average grade for all 500 series courses must be B or better on a credit hour basis before the student can become eligible for an advanced degree.

As a rule, it is not permissible to select a minor in the same field as the major. No student shall receive both graduate and undergraduate credit for the same course.

**Maximum Credit Load.** Fifteen credit hours per semester or one credit hour per week for Summer School is to be the maximum load for students who are devoting all of their time to graduate work. Persons who are employed on a full time basis may not carry more than six semester credits per semester. These load limits are exclusive of
credits for Research courses. The maximum graduate load for students devoting part time to graduate study and part time to staff duties will be determined by their terms of employment.

**Transferred Credits.** Credits obtained in a different but recognized institution, not exceeding six semester hours, may be transferred and credited to the Master's degree provided that the work was of graduate character and provided that transferred credit does not reduce the minimum residence period of one academic year. No credit toward graduate degrees may be obtained by correspondence or extension study.

**Language Requirement.** A reading knowledge of one modern language is required by some departments.

**Recommendation for Degree.** Each candidate for an advanced degree, after the completion of the required thesis, and at least two weeks before it is expected that the degree will be awarded, must pass such examination as may be required by a committee to be appointed by the Chairman of the Graduate Committee. This committee shall ascertain the general knowledge of the candidate with particular reference to the major subject and the thesis. It shall report its findings and recommendations to the Chairman of the Graduate Committee, who in turn, will present them to the Graduate Committee for appropriate action.
DESCRIPTION OF COURSES

Enrollment in courses numbered 500 and above is limited to graduate students. The 300 and 400 series courses listed below are acceptable for graduate credit under conditions outlined under “Requirements”. Complete descriptions of these courses open to both graduates and under-graduates can be found in the general catalog.

AGRICULTURAL ECONOMICS

Ag Ec 352—Public Finance—3 cr. (3 and 0)
Ag Ec 356—Agricultural-Industrial Relations—3 cr. (3 and 0)
Ag Ec 401—Statistics—3 cr. (2 and 3)
Ag Ec 451—Economics of Cooperation—3 cr. (3 and 0)
Ag Ec 452—Agricultural Policy—3 cr. (3 and 0)
Ag Ec 455—International Trade—3 cr. (3 and 0)
Ag Ec 456—Prices—3 cr. (3 and 0)
Ag Ec 460—Agricultural Finance—3 cr. (3 and 0)
Ag Ec 462—Applied Statistics—3 cr. (3 and 0)

RS 454—Farmers' Movements—3 cr. (3 and 0)
RS 459—The Rural Community—3 cr. (3 and 0)
RS 461—Rural Leadership—3 cr. (3 and 0)

Ag Ec 501—Advanced Farm Management—3 cr. (2 and 3)

Study and appraisal of methods of assembling and analyzing information concerning the business of farming. Prerequisites: Ag Ec 302 and Ag Ec 401.
Ag Ec 503—Land Economics—3 cr. (3 and 0)
A study of characteristics of land and its relation to population, utilization and public policies.

Ag Ec 505—Economic Theory—3 cr. (3 and 0)
A review of economic principles, a study of the use of theory in the analysis of economic problems, and an appraisal of recent developments in capitalistic economic theory.

Ag Ec 507—Agricultural Marketing Problems—3 cr. (3 and 0)
A study of special problems involved in marketing southern fruits, vegetables, livestock and livestock products. Students will undertake individual assignments in the field of their interest.

Ag Ec 512—Experimental Designs—3 cr. (3 and 0)
An examination of the ways to plan and conduct comparative experiments so they will provide, efficiently, specific answers to scientific questions under investigation. Prerequisite: Ag Ec 401 or permission of instructor.

Ag Ec 591—Research—3 cr.
Ag Ec 592—Research—3 cr.

AGRICULTURAL ENGINEERING

Ag En 401—Soil and Water Conservation Engineering—3 cr. (2 and 3)
Ag En 402—Drainage and Irrigation—3 cr. (2 and 3)
Ag En 451—Farm Structures—3 cr. (2 and 3)
Ag En 452—Advanced Farm Structures—3 cr. (2 and 3)
AGRONYM

Agron 301—Fertilizers and Manures—3 cr. (3 and 0)
Agron 302—Genetics—3 cr. (2 and 3)
Agron 306—Forage Crops—3 cr. (3 and 0)
Agron 405—Plant Breeding—3 cr. (2 and 3)
Agron 409—Cotton and Tobacco—3 cr. (3 and 0)
Agron 451—Mineral Nutrition of Plants—2 cr. (2 and 0)
Agron 452—Soil Class., Fertility and Mgt.—2 cr. (2 and 0)
Agron 455—Crops Seminar—1 cr. (1 and 0)
Agron 456—Seminar—1 cr. (1 and 0)

Agron 501—Advanced Nutrition of Crops—3 cr.
A graduate course dealing with the relationship existing between the physical and chemical properties of the various nutrient elements and their absorption and utilization by plants.

Agron 502—Advanced Pedology and Soil Classification—3 cr.
A graduate course dealing largely with the factors of soil formation and soil classification. A thorough study is made of such factors of soil formation as parent material, topography, climate, and organisms. Particular attention is given to the classification of Southeastern soils.

Agron 503—Advanced Crop Production—3 cr.
A graduate course dealing with specific problems commonly encountered in the production of crops in the Southeast. Major attention is given to the problems met with the production of cotton, bright tobacco, corn and oats.

Agron 504—Advanced Plant Breeding and Genetics—3 cr.
A graduate course designed to acquaint the student with the best methods now employed in the production and development of supe-
rior strains of plants. Visits will be made to neighboring plant breeding establishments and their methods will be observed.

Agron 591—Research—3 cr.
Agron 592—Research—3 cr.

**ANIMAL HUSBANDRY**

A H 310, 314—Pork Production—3 cr. (2 and 3)
A H 401, 403—Beef Production—3 cr. (2 and 3)
A H 451—Advanced Feeds—2 cr. (2 and 0)
A H 452—Animal Breeding—3 cr. (2 and 3)
A H 455—Farm Meats—2 cr. (0 and 6)
A H 456, 458—Advanced Meats—2 cr. (1 and 3)

A H 501—Animal Histology—3 cr. (2 and 3)

This course is to acquaint the student with the microscopic structures of the tissues and organs of the animal body. The relation of histology to physiology and pathology is considered. **Prerequisites:** Zool 101 and 103.

A H 502—Animal Husbandry Research—2 cr. (1 and 3)

Special problems conducted by the student, consisting of lectures, assignments, and laboratory.

**ARCHITECTURE**

Arch 301—Architectural Design—5 cr. (0 and 15)
Arch 302—Architectural Design—5 cr. (0 and 15)
Arch 401—Architectural Design—6 cr. (0 and 18)
Arch 402—Architectural Design—6 cr. (0 and 18)
Arch 409—Art Appreciation—3 cr. (3 and 0)
Arch 415—Building Design—2 cr. (2 and 0)
Arch 417—Working Drawings—2 cr. (0 and 6)
Arch 418—Construction—2 cr. (2 and 0)
Arch 425—Building Design—2 cr. (2 and 0)
Arch 427—Working Drawings—4 cr. (1 and 9)
Arch 428—Working Drawings—4 cr. (1 and 9)
Arch 431—Arch. Design and City Planning—7 cr. (0 and 21)
Arch 432—Architectural Design—7 cr. (0 and 21)
Arch 439—History of Architecture—3 cr. (3 and 0)
Arch 440—History of Architecture—3 cr. (3 and 0)

BACTERIOLOGY

Bact 301, 303—General Bacteriology—4 cr. (3 and 3)
Bact 402, 404—Dairy Bacteriology—3 cr. (2 and 3)
Bact 406, 408—Sanitary Bacteriology—4 cr. (3 and 3)
Bact 410, 412—Soil Microbiology—3 cr. (2 and 3)
Bact 502, 504—Advanced Bacteriological Technic—4 cr. (2 and 6)

A course including methods of preparing special equipment for use in the bacteriological laboratory, sterilization by filtration, isolation of viruses, immunological procedures, and the experimental infection of plants and animals. This course is destined to give students interested in research in the field of bacteriology and plant pathology experience in more advanced methods of investigation. **Prerequisites:** Bact 301, 303, Bot 401, 403.
BOTANY

Bot 351, 353—Plant Morphology—4 cr. (2 and 6)
Bot 352, 354—Plant Physiology—4 cr. (3 and 3)
Bot 355—Histology—2 cr. (0 and 6)
Bot 356, 358—Taxonomy—3 cr. (1 and 6)
Bot 401, 403—Plant Pathology—3 cr. (2 and 3)
Bot 451, 453—Morphology of the Fungi—3 cr. (2 and 3)

Bot 501—Methods of Research in Plant Physiol.—3 cr. (2 and 3)

A theoretical and practical study of methods used in investigations of physiological processes and the factors influencing those processes. Topics include sand and solution culture methods, measurement and control of soil water content, atmospheric humidity and radiant energy, and determinations of osmotic quantities, hydrogen ion concentration, and metabolic processes. Prerequisites: Bot 352, 354; Chem 101, 102; Phys 201, 202, 203, 204.

Bot 503—Advanced Plant Pathology—4 cr. (3 and 3)

An advanced study including epiphytology and etiology of diseases of plants, nature of parasitism and resistance and training in laboratory methods. Prerequisites: Bot 401, 403.

CERAMIC ENGINEERING

Cr En 401—Silicates—5 cr. (3 and 6)
Cr En 402—Refractories—3 cr. (3 and 0)

CHEMICAL ENGINEERING

Ch En 301—Principles of Chem. Engr.—3 cr. (3 and 0)
Ch En 302—Principles of Chem. Engr.—3 cr. (3 and 0)
Ch En 305—Unit Operations—1 cr. (0 and 3)
CHM 306—Unit Operations—1 cr. (0 and 3)
CHM 401—Principles of Chem. Engr.—3 cr. (3 and 0)
CHM 403—Chemical Industries—3 cr. (3 and 0)
CHM 404—Chemical Industries—3 cr. (3 and 0)
CHM 405—Unit Operations—2 cr. (0 and 6)
CHM 406—Industrial Chemical Calculations—2 cr. (2 and 0)
CHM 409—Plant Design—2 cr. (0 and 6)
CHM 410—Plant Design—2 cr. (0 and 6)

CHEMISTRY

A candidate for the Master's degree must demonstrate a satisfactory reading knowledge of a modern foreign language before beginning research. The modern language will be German unless some other language is recommended by the candidate's committee.

A candidate for the Master's degree will have a general major in Chemistry and a minor in a department outside of the School of Chemistry. The courses required for a general major in Chemistry will consist of three four-hour advanced courses; one in Inorganic Chemistry, one in Organic Chemistry, and one in Physical Chemistry. The required research and thesis may be taken in Inorganic, Analytical, Organic, or Physical Chemistry.

A candidate must have completed the following undergraduate requirements with an overall B average before he can become a candidate for the Master's degree in Chemistry.

One year of Gen. Chemistry.    One year of Analytical Chemistry.
One year of Org. Chemistry.    One year of Physical Chemistry.
Five semester hours of advanced work in Chemistry.

Anyone not satisfying these requirements must make up the deficiency before becoming a candidate for the Master's degree. Any of these prerequisites that have to be completed at Clemson by a candidate must be removed within two calendar years and the candidate must maintain an overall B average in such work.

A candidate for the Master's degree will be required to complete satisfactorily a comprehensive written examination at least two months prior to the final oral examination.
Chem 321—Qualitative Organic Analysis—4 cr. (2 and 6)
Chem 331—Physical Chemistry—3 cr. (3 and 0)
Chem 332—Physical Chemistry—3 cr. (3 and 0)
Chem 333—Physical Chemistry Lab.—2 cr. (0 and 6)
Chem 334—Physical Chemistry Lab.—2 cr. (0 and 6)
Chem 401—Inorganic Chemistry—3 cr. (3 and 0)
Chem 402—Inorganic Chemistry—3 cr. (3 and 0)
Chem 411—Adv. Quantitative Chemistry—3 cr. (1 and 6)
Chem 431—Colloid Chemistry—2 cr. (2 and 0)
Chem 432—Colloid Chemistry—2 cr. (2 and 0)
Chem 443—Research Problems—3 cr. (0 and 9)
Chem 444—Research Problems—3 cr. (0 and 9)
Chem 454—Inorganic Synthesis—2 cr. (0 and 6)
Chem 462—Technical Analysis—3 cr. (1 and 6)
Chem 472—Organic Synthesis—4 cr. (1 and 9)
Chem 473—Organic Medicinal Compounds—2 cr. (2 and 0)
Chem 482—Chemical Thermodynamics—3 cr. (3 and 0)
Chem 484—Colloid Chemistry Laboratory—2 cr. (0 and 6)

Chem 501—Advanced Inorganic Chemistry—4 cr. (4 and 0)

A study of atomic, crystal and molecular structure and its relationship to Inorganic Chemistry. **Prerequisites:** Chem 401 and 402.

Chem 520—Biochem. Aspects of Org. Chem.—3 cr. (3 and 0)

Discussion of natural products, including vitamins, hormones, etc. **Prerequisites:** Chem 321 and 331.
Chem 521—Advanced Organic Chemistry—4 cr. (4 and 0)

The object of this course is to give a general survey of organic chemistry with special attention on the general type of organic reactions and important processes. The lectures are supplemented by assigned problems and reports on current organic literature which are discussed during a weekly conference hour. Prerequisite: Chem 321.

Chem 523—Quantitative Organic Analysis—3 cr. (1 and 6)

This course is designed to train the organic chemist, and particularly the research worker, in the techniques and theory of quantitative determinations of various groups and elements occurring in organic compounds. Semimicro methods using 10 to 25 mg. samples are stressed. It is primarily a laboratory course with occasional lectures for consideration of the theoretical aspects of the procedures employed. Prerequisites: Chem 321 and 411.

Chem 532—Advanced Physical Chemistry—4 cr. (4 and 0)

An advanced course covering special phases of Physical Chemistry such as recent advances in the theory of solutions, chemical kinetics, catalysis and phase equilibrium. Prerequisites: Chem 331 and 332.

Chem 591—Research—3 cr.

Chem 592—Research—3 cr.

CIVIL ENGINEERING

C E 305—Route Surveying—3 cr. (3 and 0)
C E 307—Roads and Pavements—4 cr. (3 and 3)
C E 309—Stress Analysis—2 cr. (0 and 6)
C E 310—Elementary Design—2 cr. (0 and 6)
C E 317—Materials and Methods of Construction—3 cr. (3 and 0)
C E 401—Structural Design—3 cr. (2 and 3)
C E 402—Structural Analysis—2 cr. (2 and 0)
C E 409—Reinforced Concrete Structures—4 cr. (3 and 3)
C E 410—Municipal and Sanitary Engr.—4 cr. (3 and 3)
C E 412—Reinforced Concrete Design—2 cr. (0 and 6)
C E 414—Soil Mechanics—3 cr. (2 and 3)
C E 421—Contracts—2 cr. (2 and 0)
C E 417—City Planning—2 cr. (2 and 0)
C E 452—Advanced Structural Analysis—2 cr. (2 and 0)

C E 501—Adv. Structural Engineering—3 cr. (2 and 3)

Analysis of statically indeterminate structures including secondary stresses and rigid frames.

C E 502—Adv. Structural Engineering—3 cr. (2 and 3)

A continuation of C E 501.

C E 510—Highway Safety and Traffic Control—3 or 2 cr. (3 and 0) or (2 and 0)

Study of highway safety principles affecting the design of city streets and rural highways, devices for controlling highway traffic and related subjects, and design of traffic signal systems. **Prerequisite:** C E 306.

C E 511—Highway Design—3 cr. (2 and 3)

Studies of economics of highway grades, location, alignment and road surfaces, and factors that control highway planning. **Prerequisite:** C E 306.
C E 519—Highway Research—2 to 4 cr.

Independent investigation of some problems in highway engineering.

C E 520—Concrete Mixes and Materials—3 cr. (2 and 3)

Properties and factors controlling properties of concrete; investigation and selection of materials; mixes and design of mixes; inspection, field laboratory facilities and reports; concrete manufacture; handling, placing and curing; special types; sonic method of testing. Prerequisite: C E 405.

C E 531—Soil Engineering—3 cr. (2 and 3)

Shearing resistance consolidation, settlement, displacement, and compaction, pile supporting strength, application of principles to earthwork, foundations and highway problems. Prerequisite: C. E. 415.

C E 591—Research—3 cr.

C E 592—Research—3 cr.

DAIRYING

Dairy 306—Market Milk—3 cr. (3 and 0)
Dairy 309—Animal Nutrition—3 cr. (3 and 0)
Dairy 352—Advertising and Marketing—3 cr. (3 and 0)
Dairy 354—Endocrinology—3 cr. (3 and 0)
Dairy 401—Dairy Manufactures—3 cr. (2 and 3)
Dairy 402—Dairy Manufactures—4 cr. (2 and 6)
Dairy 405—Dairy Cattle Breeding—3 cr. (2 and 3)
Dairy 452—Dairy Cattle Feeding and Management—3 cr. (2 and 3)
Dairy 501—Topical Problems—1 to 3 cr.

Topics of interest to the graduate student. The course is designed to give experience with problems in dairying not covered by thesis research. Credit varies with the problem selected.

Dairy 502—Genetics of Dairy Cattle Improvement—3 cr.

(3 and 0)

Study of the inheritance in dairy cattle, with emphasis on milk and butterfat production, methods used in proving sires and dams and in analyzing herds as aids to selection.

Dairy 503—Physiology of Reproduction and Milk Secretion—3 cr.

(3 and 0)

A study of the influence of the endocrine glands on reproduction and on milk secretion.

Dairy 505—Newer Knowledge of Animal Nutrition—3 cr.

(3 and 0)

The application of the latest information on digestion, metabolism, and the nutritional requirements of animals.

Dairy 591—Research—3 cr.

Dairy 592—Research—3 cr.

DRAWING AND DESIGNING

D D 460—Mechanical Vibrations—3 cr. (3 and 0)
D D 461—Photoelasticity—2 cr. (1 and 3)
Students desiring to pursue graduate work with a major in the field of Education are expected to have as prerequisite enough work in this field to qualify them for a teachers certificate under the rules of the State Board of Education. Students desiring to minor in this field must have completed prerequisites for the state certificate or must include in their graduate program enough work to qualify them for this certificate.

Candidates for the Master's degree in the School of Education will select a major in Education, Industrial Education or Vocational Agricultural Education. Educ 505, Educ 506, Educ 508, and Educ 591 are required courses for all candidates whose majors are to be in this School. In addition to these courses, each candidate will be expected to complete one additional course in research and at least two of the other courses listed below. A minor must be completed in some field outside of the School of Education.

Educ 421—Coordination Methods in Voc. Ed.—2 cr (2 and 0)
Educ 424—Technique of Teaching—3 cr. (3 and 0)
Educ 432—Job Analysis and Course Construction—3 cr.
Educ 458—Health Education for Teachers—3 cr. (3 and 0)
Educ 497—Audio-Visual Aids—3 cr.

Educ 501—Recent Developments in the Technology of Agriculture—3 cr. (3 and 0)

This course will include a thorough analysis and appraisal of the experimental findings and successful farming practices developed during World War II and in the post war period in the various fields of agriculture. It is designed to bring agricultural workers "up-to-date" in their knowledge and thinking in agricultural technology to the end that they may render more efficient service to rural people. Emphasis in this course will be on crops and mechanization.

Educ 502—Recent Developments in the Technology of Agriculture—3 cr. (3 and 0)

A continuation of 501 with emphasis in developments in animal sciences and agricultural economics.
Educ 503—Advanced Methods in Teaching—3 cr. (2 and 3)

The principles and practices involved in promoting effective learning will be developed in this course which is planned primarily for assisting experienced teachers who wish to improve their teaching procedures. Creating interest, inducing desired learning activities, causing intelligent use of what is learned, and measuring and evaluating results of teaching will be emphasized.

Educ 504—Special Problems in Teaching Vocational Agriculture—3 cr. (2 and 3)

This course will be devoted to the analysis, exploration and development of plans for the solution of some of the current problems being encountered by teachers of Vocational Agriculture. Planning adequate programs of work, planning needed buildings and equipment, securing and training assistant and/or special teachers, promoting cooperative effort and similar problems will be chosen or assigned for individual and group effort.

Educ 505—Occupational Guidance and Placement—3 cr. (3 and 0)

The organization and administration of a guidance program for schools of all sizes. A careful analysis is made of methods of interviewing students and counseling techniques involved in guidance. Data are collected on placement and follow-up work. A careful study is made of the needs for guidance in communities near the College.

Educ 506—History and Philosophy of Education—3 cr. (3 and 0)

This course attempts to study the development of education over the different periods of civilization beginning with Athenian education and tracing the educational movements through the different periods of history with emphasis being placed upon the development of education in the United States. With each period studied attention is first directed to the central features of the social order, the dominant ideology, to the social structure, the classes of economic interest, and to the sources of political power, and the formation of political institutions and social arrangements. Educational policies and practices and newer philosophy of American education are given detailed attention.
Educ 508—Educational Tests and Measurements—3 cr. (3 and 0)

A study of improved methods and techniques which may be used in the measurement of intelligence, specific aptitudes, and achievement. A survey is made of standardized tests, the sources from which they may be secured, and the purposes which may serve in classification and/or instruction of students. Emphasis is given to the construction of informal tests of achievement, and to the administration and interpretation of standardized group tests. Practice is provided in the use of standardized tests. The relationship of time and motion studies to industrial operations is considered.

Educ 511—Public School Administration (Finance)—3 cr. (3 and 0)

Sound principles and suitable procedures relating to school administration and finance especially for the size school districts represented by the membership of the class.

Educ 517—Audio Visual Aids in Teaching—3 cr. (2 and 3)

This course will consider the use of audio and visual aids in a school program. Such phases as cost, securing and evaluating of machines, instruments, supplies, films, charts, maps, globes will be considered. Sound recording, classroom intercom and radio units, and television will be studied and evaluated for educational purposes. Prerequisite: Graduate standing, with teaching experience or at least three courses in Education, instructor's approval.

Educ 520—Teaching Young Farmers—3 cr. (3 and 0)

The purpose of this course is to provide training for young farmers establishing themselves in the business of farming. Emphasis will be placed upon organization, cooperation and private enterprise. Buying and selling on various types of markets will be covered. The uses of governmental facilities for handling goods, credit, communications, and power will be studied. Conservation as a community and individual enterprise will be discussed. Limited number of field trips will be considered. How young farmers may cooperate with younger F.F.A., 4-H Club, and older farmers will be stressed.
Educ 521—Adult Education Development and Administration—3 cr. (3 and 0)

A critical analysis of adult education movement and its influence on trade and industrial workers; the applicability of educational practices to industrial training problems; major fields of training in industry; evaluation of unions participation in education programs; psychological approaches to problems in worker-management relations.

Educ 561—Administration and Supervision of Vocational Education—3 cr.

The expanding program of vocational education under the George-Barden Act and problems on national, state and local levels will be discussed. Major specific problems in unit trade programs, out-of-school youth, selection and training of teachers, veteran training and others will be covered.

Educ 591—Research in Education—3 cr.
Educ 592—Research in Agricultural Education—3 cr.
Educ 594—Research in Education—3 cr.
Educ 596—Research in Industrial Education—3 cr.

ELECTRICAL ENGINEERING

E E 311—Direct-Current Machinery—4 cr. (3 and 3)
E E 315—Alternating-Current Circuits—3 cr. (3 and 0)
E E 316—Alternating-Current Circuits—4 cr. (3 and 3)
E E 320—Electronics—4 cr. (3 and 3)
E E 405—Electrical Design—1 cr. (0 and 3)
E E 406—Electrical Design—1 cr. (0 and 3)
E E 411—Alternating-Current Machinery—5 cr. (3 and 6)
E E 412—Alternating-Current Machinery—4 cr. (3 and 3)
E E 415—Advanced Circuits—3 cr. (3 and 0)
EE 422—Electric Distribution—2 cr. (2 and 0)
EE 425—Electric Transients—3 cr. (2 and 3)
EE 427—Advanced A C Machinery—3 cr. (3 and 0)
EE 431—Radio Communication—4 cr. (3 and 3)
EE 432—Radio Communication—4 cr. (3 and 3)
EE 434—Industrial Electronics—3 cr. (2 and 3)
EE 436—Radiation and Wave Propagation—3 cr. (3 and 0)

EE 501—Advanced Electric Transients—3 cr. (2 and 3)
Application of both Heaviside operational analysis and classical methods to electric transients; machinery transients involving circuits with time-varying parameters; transmission line transients. Development of experimental technique and verification of theory of oscillographic work in the laboratory.

EE 511—Electric Power Stations—3 cr. (3 and 0)
A comprehensive study of station lay-out generating equipment, exciters, transformers, meters, switching protective devices. Economical arrangement and operation is emphasized.

EE 520—Ultra-High Frequency Techniques—4 cr. (3 and 3)
Applications of conventional tubes at high frequencies, characteristics of the magnetron and velocity modulated tubes. Cathode ray tubes and circuits, applications of transmission lines, wave guides and cavity resonators. Prerequisite: EE 432 or the equivalent.

EE 521—Radiation and Wave Propagation—3 cr. (3 and 0)
An advanced study of electric fields, vector analysis, Maxwell's equations and their use in the study of wave guides, radiation, and wave propagation.

EE 591—Research—3 cr.
EE 592—Research—3 cr.
ENTOMOLOGY

Ent 401—Economic Entomology—3 cr. (2 and 3)
Ent 402—Economic Entomology—3 cr. (2 and 3)
Ent 405—Insect Morphology—3 cr. (2 and 3)
Ent 451—Research Techniques and Methods—2 cr. (1 and 3)
Ent 452—Insect Taxonomy—2 cr. (1 and 3)
Ent 456—Parasitology—3 cr. (2 and 3)

Ent 505—Advanced Morphology—3 cr. (2 and 3)
Principles of insect morphology with the detailed morphology of a taxonomic group. **Prerequisite:** Ent 405.

Ent 552—Advanced Systematic Entomology—2 cr. (0 and 6)
A survey of taxonomic literature, with a detailed study of a selected taxonomic group. **Prerequisite:** Ent 452.

Ent 556—Medical Entomology—3 cr. (2 and 3)
Disease vectors of animals with emphasis on insects and related Arthropod disease carriers. **Prerequisite:** Ent 301.

Ent 561—Insect Toxicology—3 cr. (2 and 3)
History, development, application, chemical nature and mode of action of insecticides. **Prerequisites:** Chem 220 and Ent 401 or 402.

Ent 562—Insect Physiology—3 cr. (2 and 3)
The physiology of nutrition, digestion, respiration, excretion, nervous and hormonal systems. **Prerequisites:** Chem 220 and Ent 405.

Ent 591—Research—3 cr.
Ent 592—Research—3 cr.
HISTORY AND GOVERNMENT

To be eligible to obtain graduate credit for courses in History and Government the student should have earned at least twelve semester hours for undergraduate work in this field. The student will schedule the course along with undergraduate students but will be expected to complete such additional assignments as the instructor may require.

Hist 308—Europe Since 1918—3 cr. (3 and 0)
Hist 401—History of South Carolina—3 cr. (3 and 0)
Hist 403—History of the South to 1865—3 cr. (3 and 0)
Hist 404—History of the South since 1865—3 cr. (3 and 0)
Hist 405—The American Frontier—3 cr. (3 and 0)

Govt 401—Comparative Government—3 cr. (3 and 0)

HORTICULTURE

Hort 301—Principles of Vegetable Production—3 cr. (2 and 3)
Hort 306, 308—Landscape Design—3 cr. (2 and 3)
Hort 401, 403—Landscape Design—3 cr. (2 and 3)
Hort 402, 404—Garden Design—3 cr. (2 and 3)
Hort 405—Nut Culture and Sprays—3 cr. (2 and 3)
Hort 415—Floriculture—3 cr. (2 and 3)
Hort 451—Systematic Pomology and Small Fruit Culture—3 cr. (2 and 3)
Hort 452—Commercial Pomology—3 cr. (2 and 3)
Hort 455—Breeding Horticultural Crops—3 cr. (2 and 3)
Hort 456—Truck Crops—3 cr. (2 and 3)
Hort 460—Advanced Landscape Design—3 cr. (2 and 3)
Hort 464—Food Preservation—3 cr. (2 and 3)
Hort 501—Problems in Small Fruit Production—3 cr. 
(2 and 3)

The course involves a study of selected problems encountered in 
the production of blueberries, strawberries, brambles, and grapes. 
Prerequisite: Hort 451.

Hort 503—Advanced Vegetable Crops—3 cr. (3 and 0)

The course involves a systematic study of sources of information 
and practices with emphasis on the application of this knowledge 
to the solution of problems encountered in the production and 
handling of vegetable crops. Prerequisite: Hort 456.

Hort 505—Food Technology—3 cr. (1 and 6)

The subject matter includes quality control methods and equip-
ment such as special titrations, taste panels, refractometers, suc-
culometers, tenderometers, and colorimeters; the role of sugars, 
 salts, acids, and chemical preservatives in foods; quality grade 
standards; and special problems. Prerequisites: Bact 301, 303; 
Hort 464.

Hort 507—Advanced Pomology—3 cr. (2 and 3)

A study of the growth and development of deciduous fruits with 
most emphasis on the peach and apple. Prerequisite: Hort 452.

Hort 591—Research—3 cr.

Hort 592—Research—3 cr.

INDUSTRIAL ENGINEERING

In En 402—Metallurgy—3 cr. (2 and 3)
MATHEMATICS

Math 302—Theory of Equations—3 cr. (3 and 0)
Math 304—Statistics—3 cr. (3 and 0)
Math 305—Intermediate Calculus—3 cr. (3 and 0)
Math 306—Ordinary Differential Equations—3 cr. (3 and 0)
Math 451—Vector Analysis—3 cr. (3 and 0)
Math 453—Advanced Calculus—3 cr. (3 and 0)
Math 454—Advanced Calculus—3 cr. (3 and 0)
Math 455—Advanced Mathematics for Engineers—3 cr. (3 and 0)
Math 456—Advanced Mathematics for Engineers—3 cr. (3 and 0)

Mathematics 306, 451, 455, and 456 are recommended for students who are pursuing advanced work in the fields of Engineering; Mathematics 302, 304, 305 for economic majors; and Mathematics 306, 451, 453, and 454 for majors in sciences.

MECHANICAL ENGINEERING

M E 311—Heat Power—3 cr. (3 and 0)
M E 312—Heat Power—3 cr. (3 and 0)
M E 411—Heat Power—3 cr. (3 and 0)
M E 412—Heat Power—3 cr. (3 and 0)
M E 413—Heat Power Laboratory—2 cr. (0 and 6)
M E 414—Heat Power Laboratory—2 cr. (0 and 6)
M E 417—Design—2 cr. (1 and 3)
M E 418—Design—2 cr. (1 and 3)
M E 421—Gas Engines—3 cr. (3 and 0)
An analysis of the principles of air conditioning. The following topics are among those covered; enthalpy of air-vapor mixtures; adiabatic mixtures of air with water, steam, or ice; fogged air; adiabatic saturation; air in contact with water; fundamental simultaneous and fundamental successive conditioning processes; humid air below 32 degrees F.; geometry of the psychrometric chart. A critical analysis of current literature on special topics. **Prerequisites:** ME 429, 430, 431, and 432.

**ME 510—Advanced Thermodynamics—3 cr. (3 and 0)**

This course supplements and extends the material covered in elementary thermodynamics. Special topics relative to advanced problems in engineering are pursued. **Prerequisites:** ME 311, 312, 411, 412, and registration in Math 306.

**ME 521—Internal Combustion Engines—3 cr. (3 and 0)**

Internal combustion process analysis, deviation from the ideal processes, detonation, and knock testing, carburation and fuel injection, combustion chamber and cylinder head design, engine cooling, mechanics of principle moving parts, engine vibration and balance and engine design.
ME 522—Internal Combustion Engines—3 cr. (3 and 0)
A continuation of ME 521.

ME 523—Internal Combustion Engine Laboratory—1 cr.
(0 and 3)
Analysis of engine instrumentation, air-fuel ratio tests, detonation limited power test, injection and analysis with test apparatus, fuels testing and general test codes.

ME 524—Gas Turbines—3 cr. (3 and 0)
Gas turbine process analysis, deviation from the ideal processes, fuels stratification, efficiencies, pressure ratio including the development of charts for cycle analysis.

ME 526—Advanced Steam Turbines—2 cr. (2 and 0)

ME 528—Advanced Steam Turbines Design—1 cr. (0 and 3)

ME 532—Applied Heat Transfer—3 cr. (3 and 0)
The application of heat transfer to several engineering problems pertaining to the design of heat transfer equipment such as boilers, condensers, evaporators, and air preheaters. Prerequisites: ME 312, 411, 412 and registration in Math 306.

ME 591—Research—3 cr.

ME 592—Research—3 cr.

MECHANICS AND HYDRAULICS

Mech 401—Fluid Mechanics—3 cr. (3 and 0)
Mech 403—Fluid Mechanics Laboratory—1 cr. (0 and 3)
Mech 460—Hydrology—2 or 3 cr. (2 or 3 and 0)
Mech 462—Water Power Engineering—2 or 3 cr. (2 or 3 and 0)
Mech 464—Flow in Open Channels—2 or 3 cr. (2 or 3 and 0)

Mech 502—Special Topics in Mechanics of Materials—3 cr.
(3 and 0)

A study of the general state of stress, strain-energy methods, theories of failure, indeterminate problems in bending, curved bars, dynamic stresses, plates and problems of elastic stability. Prerequisites: Mech 304 and graduate standing.

Mech 504—Dynamics—3 cr. (3 and 0)

A development of more advanced methods of analysis of problems in dynamics with emphasis on practical solutions. Topics are systems with variable mass and variable forces, shaking forces, balancing, vibration, gyroscopes and models. Prerequisites: Mech 303 and graduate standing.

Mech 506—Fluid Mechanic II—3 cr. (3 and 0)

A comprehensive study of the principles of fluid flow and the application of the principles to practical engineering problems. Among the topics considered are fluid velocity and acceleration, significance of the flow net, pressure distributions, viscosity, surface tension, compressibility, boundary layer, and circulation and magnus effect. Prerequisites: Mech 401 and graduate standing.

Mech. 508—Flood Control—3 cr. (3 and 0)

A study of the hydrology of floods and the engineering considerations relating to their control. Topics considered in the scope of control measures are economic justification, types of control structures and a survey of flood control measures on major streams in the U. S. Prerequisites: Mech 460 and graduate standing.
Mech 510—Advanced Hydrology—2 cr. (2 and 0)

Special work to strengthen the student's background in modern methods. The technical literature is used extensively for latest developments. Emphasis is laid on work on evaporation, infiltration and the synthetic hydrograph. Prerequisites: Mech 460 and graduate standing.

Mech 512—Hydraulic Projects—3 cr. (3 and 0)

This course is devoted to the detailed investigation of engineering problems in hydraulics and related fields. Application of theoretical principles developed in previous courses is emphasized. Subjects include: Spillway and stilling basin; Reservoirs; inverted siphons. Prerequisites: Mech 460, Mech 464; must be accompanied or preceded by Mech 506.

Mech 591—Research—3 cr.
Mech 592—Research—3 cr.

PHYSICS

Phys 312—Heat and Kinetic Theory—4 cr. (4 and 0)
Phys 314—Experimental Heat—1 cr. (0 and 3)
Phys 321—Mechanics and Properties of Matter—4 cr. (4 and 0)
Phys 323—Experimental Mechanics—1 cr. (0 and 3)
Phys 432—Light—4 cr. (4 and 0)
Phys 434—Experimental Light—1 cr. (0 and 3)
Phys 441—Magnetism and Electricity—4 cr. (4 and 0)
Phys 443—Experimental Electricity—1 cr. (0 and 3)
Phys 452—Atomic and Nuclear Physics—3 cr. (3 and 0)
Phys 511—Thermodynamics—3 cr. (3 and 0)

A study of the laws of the thermodynamics entropy and properties of pure substances, engine cycles, the applications of thermodynamics to various systems and applications to chemical systems.
Phys 512—Kinetic Theory and Statistical Mechanics—3 cr. (3 and 0)

A development of the kinetic theory of gases including derivations of relationships between molecular diameters, distribution of velocities, mean free paths, viscosity, thermal conductivity, specific heat, entropy, probability and reaction kinetics. The basic concepts of statistical mechanics for classical and quantum systems will be developed.

Phys 521—Dynamics—3 cr. (3 and 0)

A study of the more advanced phase of dynamics including the equations of Lagrange and Hamilton, generalized coordinates, oscillatory and cyclic motion and the Newtonian potential theory.

Phys 541—Electrodynamics—3 cr. (3 and 0)

This course starts with Maxwell’s equations for electric and magnetic fields and includes consideration of production and propagation of electromagnetic waves, wave optics and theories of interference and diffraction.

Phys 551—Introduction to Quantum Mechanics—3 cr. (3 and 0)

An introductory course formulating the mathematical and physical ideas associated with wave mechanics. Solution of simple physical systems including the hydrogen atom are discussed. Prerequisites: Phys 301 and Math 306.

Phys 552—Theory of Atomic Spectra—3 cr. (3 and 0)

A study of the excitation of spectra, computation of wavelengths from spectral photographs, the computation of energy levels and the correlation with theories of atomic structure.

Phys 553—Nucleonics—3 cr. (3 and 0)

This course is designed to give the basic properties of and the experimental methods employed in the study of particles associated with the nucleus. A survey is made of the theories so far advanced for the interaction of these particles and the theories pertaining to the structure of simple nuclei.

Phys 591—Research—3 cr.

Phys 592—Research—3 cr.
POULTRY

PH 451—Poultry Breeding—3 cr. (2 and 3)
PH 452—Poultry Feeding and Flock Management—(3 cr. (2 and 3)
PH 455—Poultry Grading and Processing—3 cr. (2 and 3)
PH 456—Incubation and Brooding—3 cr. (2 and 3)
PH 459—Poultry Diseases and Parasites—3 cr. (2 and 3)
PH 460—Seminar—2 cr. (2 and 0)

SOCIOLOGY

To be eligible to obtain graduate credit for one or more courses in Sociology the student must have earned at least twelve semester hours credit for undergraduate work in this field. The student will schedule courses in this field along with undergraduate students but will be expected to complete such additional assignments as the instructor may require.

Soc 405—Industrial Sociology—3 cr. (3 and 0)
Soc 406—Regional Sociology—3 cr. (3 and 0)

TEXTILE CHEMISTRY

TC 410—Color Matching and Testing—1 cr. (0 and 3)
TC 447—The Chemical Processing of Textile Materials—4 cr. (4 and 0)
TC 449—Textile Chemistry Laboratory—1 cr. (0 and 3)
TC 452—The Chemical Processing of Textile Materials—4 cr. (4 and 0)
TC 454—Textile Chemistry Laboratory—1 cr. (0 and 3)
TC 455—Cellulose Chemistry—3 cr. (3 and 0)
TC 456—Chemistry of Synthetic Fibers and Finishes—2 cr. (2 and 0)
T C 511—The Theory and Application of Synthetic Resinous Materials—3 cr. (2 and 3)

The aim of the course would be to give the student a comprehensive survey of the history, present utility, and probable future expansion of synthetic resins. This subject must be considered important in the field of textiles because of the tremendous interest developed in the last few years in the use of these resins in many types of textile finishing. **Prerequisite:** T C 306.

T C 512—The Theory and Application of Synthetic Resinous Materials—3 cr. (2 and 3)

A continuation of T C 511.

T C 521—Advanced Cellulose Chemistry—3 cr. (3 and 0)

The purpose of the course would be to present the chemistry of cellulose and closely related polysaccharides, through a systematic study of the extensive volume of research which has been completed on these substances. **Prerequisite:** T. C. 455.

T C 531—Chemistry of Coloring Matters—3 cr. (2 and 3)

The work would consist of an advanced study of coloring bodies in their major forms, as dyes, pigments, and lakes. Their structure and formulation for use would be covered in detail with the chief emphasis being placed on the more complex forms, such as the vat colors and the insoluble azo compounds. **Prerequisite:** T C 452.

T C 591—Research—3 cr.
T C 592—Research—3 cr.

**TEXTILE MANAGEMENT**

T M 462—Textile Microscopy—2 cr. (1 and 3)
T M 464—Physical Textile Testing—2 cr. (1 and 3)
ZOOLOGY

Zool 301—Advanced Zoology—3 cr. (2 and 3)
Zool 302—Vertebrate Embryology—3 cr. (2 and 3)

Zool 402—Animal Physiology—3 cr. (2 and 3)

A basic study of the physiological processes of ingestion, secretion, excretion, respiration, circulation, reproduction and metabolism of warm blooded animals. This is the only basic physiology course offered at Clemson College and is designed to be of value to students majoring in Pre-Medicine, Pre-Veterinary, Animal Husbandry, Dairy and Poultry. Prerequisites: Zool 101, 103.

Zool 502—Histological Techniques—3 cr. (1 and 6)

The fixing, staining, sectioning, and identification of all tissues, glands, and organs of animals. Prerequisites: Zool 101, 103.

Zool 556—Economic Zoology—3 cr. (2 and 3)

A study of all phylla (exclusive of Class Insecta) to include those animals either beneficial or destructive to man. Prerequisites: Zool 101, 103.

Zool 591—Research—3 cr.
Zool 592—Research—3 cr.