THE UNIVERSITY OF NORTH CAROLINA RECORD

FEBRUARY, 1920
NUMBER 173

THE GRADUATE SCHOOL

PUBLISHED BY THE UNIVERSITY
CHAPEL HILL
1920

CALENDAR

1920	
June 13-16	*Sunday to Wednesday.* Commencement.
June 22-August 6	Summer School.
June 14-August 20	Summer Law School.
September 21-22	*Tuesday and Wednesday.* Registration.
September 23	*Thursday.* Fall Quarter begins.
October 1	*Friday.* General meeting of the Graduate School, 8 P. M.
October 1	*Friday.* Last day for approval of applications for degree of Ph.D. at Commencement of 1921.
October 12	*Tuesday.* University Day.
November 25	Thanksgiving Day.
December 22	*Wednesday.* Applications for admission to candidacy for the Master's degree at Commencement of 1921 must be approved by this date. Last day for approval of thesis subjects for Master's degree at Commencement of 1921.
December 22	*Wednesday.* Fall Quarter ends. Christmas Recess begins (1:30).
1921	
January 5	*Wednesday.* Winter Quarter begins.
March 26	Winter Quarter ends.
March 27-April 3	Easter Recess.
April 4	Spring Quarter begins.
April 30	*Saturday.* Last day of period for written examinations for degree of Master of Arts.
May 4	*Wednesday.* Last day for submitting theses for degree of Ph.D.
May 14	*Saturday.* Master's theses must be submitted. Written examinations for the degree of Ph.D. may not be taken after his date.
June 6-10	Final Examinations.
June 12	*Sunday.* Baccalaureate Sermon.
June 14	*Tuesday.* Alumni Day. Meeting of the Board of Trustees.
June 15	*Wednesday.* Commencement Day. Summer Vacation begins.

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Thomas James Wilson, Jr., Ph.D., Registrar.
Eric Alonzo Abernethy, M.D., University Physician.
Frank Graham, A.M., Dean of Students.

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William Whatley Pierson, Jr., Ph.D., Associate Professor of History.
Gustave Adolphus Harrer, Ph.D., Assistant Professor of Latin.

The Graduate Faculty

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Walter Dallam Toy, M.A., Professor of the Germanic Languages and Literatures.
William Cain, A.M., LL.D., Kenan Professor of Mathematics.
Henry Horace Williams, A.M., B.D., Professor of Philosophy.
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HENRY MCCUNE DARGAN, Ph.D., Assistant Professor of English.

*JOHN WAYNE LASLEY, A.M., Assistant Professor of Mathematics.

GUSTAVE ADOLPHUS HARRER, Ph.D., Assistant Professor of Latin.

*WILLIAM WALTER RANKIN, JR., A.M., Assistant Professor of Mathematics.

ALLAN WILSON HOBBS, Ph.D., Assistant Professor of Mathematics.

CLARENCE ADDISON HIBBARD, M.A., Assistant Professor of English.

HENRY ROLAND TOTTEN, A.M., Instructor in Botany.

CLINTON WALKER KEYES, Ph.D., Instructor in Classics.

JAMES STRONG MOFFATT, JR., Ph.D., Instructor in English.

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*Absent on leave.

THE UNIVERSITY AND THE ADVANCEMENT OF LEARNING

The duty of the University not only to teach but to add to the sum of learning is implicit in a clause in the first constitution of North Carolina, adopted in December, 1776, in which it was stated that "all useful learning shall be duly encouraged, and promoted in one or more universities." The charter of the University was granted in 1789, and the cornerstone of the first building, now called Old East, was laid October 12, 1793. It was ordered that the first professorship, founded January 10, 1794, was to be held by a teacher who should be "Presiding Professor" of the University with the title of "Professor of Humanity." But from the first scientific studies were emphasized as well as the humanities, one of the acts of the Trustees in December of 1792 being a provision for the purchase of apparatus for experimental physics and for astronomy. At the time of the formal opening, set for January 15, 1795, a library was also established, made up of books donated by residents of the state, the number of volumes in each gift ranging from three to thirty-two, the total reaching nearly a hundred volumes. In 1797 the library received by gift its first "collection," consisting of 174 volumes of French works. In early times organizations of students made it part of their work to develop the library facilities of the University. The literary societies, founded in 1795, had their own collections of books, and from these beginnings the general library of the University developed.

If the beginnings of such research work as could be carried on only through the aid of proper library facilities were small, the impulse on the scientific side was surprisingly active. As early as 1817 the University published a geological survey of North Carolina that is said to be the first report of the kind in the United States. One of the most distinguished scientists of his time, Elisha Mitchell (1793-1857), was a professor in the University for many years. He published several text books on geology and mineralogy, and many articles in the *American*

Journal of Science. Other members of the faculty during the first seventy-five years of the University's history were authors of text books and scientific articles in their departments of learning. Laboratory resources were slender; experiments had to be performed by professors and not by the students, but they were performed. After 1875 a very large number of scientific papers were published by twenty-five or more men in the faculty, not including such reports as those issued by the State Geologists, who have been for many years members of the University faculty. During this period, also, several research societies were established at the University, and their proceedings have been published in the learned journals maintained by the institution.

Beginnings of Graduate Work

Though the University, like other institutions of its kind, had conferred the Master of Arts degree as an honorary degree for many years, no formal action was taken towards the establishment of graduate study until 1881. President Battle's report in that year called attention to the fact that the University was maintaining special schools of law, medicine, and pharmacy, and that the academic faculty would furnish post-graduate instruction leading to the degrees of Master of Arts and Doctor of Philosophy. These degrees would not be conferred "except upon rigid examination on prescribed courses." The first degrees of Master of Arts and Doctor of Philosophy in course were granted in 1883. In 1885 the first Graduate Bulletin was issued, a circular stating the requirements for advanced degrees in Constitutional Law, Political Economy, Classic Languages and Literature, English Language and Literature, French, German, Mathematics, Chemistry, Natural Philosophy, and in Geology, Botany, and Zoology.

At about the same time (1883) the impulse to further research at the University gained new strength through the establishment of the Elisha Mitchell society. For the first three years the society published annual volumes of proceedings; afterwards the *Journal* became a quarterly. From the first the society has stressed original research on the part of professors and advanced students and has been an immense aid to higher scientific work

at the University. The Philological Club established an annual record of research, called *Studies in Philology,* in 1906. The *James Sprunt Historical Monographs,* founded in 1899, gave opportunity for the publication of the results of advanced research in history, particularly in the history of North Carolina.

The establishment of these three learned journals in the fields of science, history, and philology, together with the activities of the research clubs which have held monthly meetings now for many years, afforded a great stimulus to investigation at the University and increased recognition of the importance of graduate work. In 1904 the Graduate Department was formally organized as a distinct school of the University and Professor C. Alphonso Smith was appointed as its first Dean.

For more than a century the spirit of investigation has been a very real element in the life of the University, constituting a tradition of rich value from which future work is to derive inspiration and authority. In days of limited equipment, remote from great libraries and laboratories, working under conditions that would have quenched a spirit less vital, members of the University were nevertheless impelled to devote themselves to research. No proper estimate either of the history of the University or of its life to-day can be made without taking into account the sincerity and worth of this achievement.

Research in the Scientific Departments

In Zoology the principal lines of investigation have been the embryology and regeneration in sponges, coelenterates, and the lower vertebrates, and the systematic zoology of sponges. The Department of Botany continues in its studies of the flora of the Carolinas, and of the reproduction and physiology of higher fungi and of water-molds. Research is in progress in the School of Medicine on acute and chronic Bright's disease, on the toxicity of anaesthetics and its prevention, and on the influence of age on certain physiological conditions. The Department of Geology has had under investigation the movements of sand dunes, the geology of North Carolina, and the relation of geology to forestry and agriculture. In Chemistry, some of the lines of work

are the chemistry of zirconium, dyes and intermediates, utilization of wastes, and discovery of new methods of research. The Department of Mathematics has made contributions to pure mathematics, especially geometry, and to the applications of mathematics to engineering problems.

Statements concerning the laboratories and scientific equipment of these departments will be found in connection with the various departmental statements below. The Elisha Mitchell Society is the clearing house for reports of scientific investigation, and various scientific departments maintain departmental clubs for professors and students.

Research in Other Departments

The Department of History has for many years been interested in various aspects of Southern history and has published many books and monographs in this field. With the acquisition, recently, of the Weeks Collection, it now possesses unrivalled facilities for further work in the field. In connection with the State Historical Library at Raleigh, which also publishes a series of valuable monographs and books, the Department finds opportunity for both research and publication. In the classics much work has been done in the field of syntax and literary history. At present the Department is doing productive work in Roman history and law, and in various aspects of Latin drama and theatrical conditions. The Department of English is best equipped, from the library standpoint, in Old and Middle English and in English literature and literary history of the sixteenth and seventeenth centuries. The special fields of investigation in which the Department is at present mainly interested are the Renaissance, Milton, and certain aspects of the eighteenth century.

Journals of Research

Three journals devoted to research in different fields of learning are maintained by the University. *The Elisha Mitchell Journal,* now in its thirty-fifth volume, has published a very large number of scientific papers, particularly in chemistry, botany, and zoology, and is regarded in this country and abroad as one of the most dis-

tinguished journals of its kind. The *James Sprunt Historical Monographs,* now in its sixteenth volume, is a series of original papers chiefly on North Carolina history, contributed by professors and advanced students in the Department of History. *Studies in Philology,* now in its seventeenth volume, originally was limited to the publication of research in philology carried on by members of the language departments at the University. In 1915 it became a quarterly, and now admits to its pages articles by scholars in other universities as well as by members of the University of North Carolina. In April of each year it publishes a series of papers dealing with English literature of the sixteenth and seventeenth centuries, called "Elizabethan Studies," and the journal is now recognized as one of the foremost American journals of philology.

The Library

The General Library of the University contains one hundred thousand volumes, constituting one of the three largest collections in the South. It has been built up with great care, the purpose being to make of it an effective working library, a laboratory for the use of students in those departments in which research must be carried on mainly by means of books, as well as an instrument contributing to general culture. The foundations having been laid, it is expected that the next few years will see great expansion in those departments of the Library which supply the materials for investigation. Already valuable special collections are in the possession of the Library, some of which are mentioned in the various departmental statements below. Notable among these, perhaps, is the Weeks collection, recently added and now in process of cataloguing. This collection, containing several thousand volumes, constitutes the most complete library of North Carolina history and literature in existence.

There are several departmental libraries, especially for the scientific departments. The Law Library, containing five thousand volumes, is at present placed in the building occupied by the Law School. It contains material useful to students of history and government. Advanced students also have the privilege of using the valuable manuscripts of the State Historical Com-

mission, at Raleigh, with the State Library, both of which are housed in a beautiful and commodious building.

The University Library receives upwards of one thousand periodicals annually. These include all important publications in this country and abroad. The learned journals which record contemporary research in all the great fields of investigation, such as the sciences, history and economics, classical and modern foreign languages and literatures, and English philology, folk-lore, and literature, are all available. The Library is a member of all important philological, bibliographical, and scientific associations, and receives their publications regularly. Bound volumes of most periodicals of permanent worth are available from the beginnings of their publication, constituting a working collection of great value to advanced students. The Library also receives the publications of such organizations as the Smithsonian and the Carnegie Institutions, and of all universities, including foreign universities, which issue monographs of advanced research.

Graduate students are given, on application, cards of admission to the book stacks, so that they have immediate access to the stores of the Library. There are also in the Library building separate seminar rooms for the departments of history, the classics, romance, germanic, and English languages and literatures. These seminar rooms are equipped with reference and bibliographical works, with long tables around which the various departmental seminars gather for their meetings, and with individual filing space for advanced students.

Situation and General Advantages

The University is situated at Chapel Hill, ten miles from Durham and twenty-eight miles from Raleigh. It may be reached by rail from University Junction, or by one of the automobile lines which maintain regular and frequent schedules from Durham. The site of the University is on a promontory of granite, belonging to the Laurentian system, about three hundred feet above the sandstone formation to the east that was once the bed of a great body of water. It is near the center of the state, midway between the mountains and the sea, with sufficient elevation to insure

healthful and pleasant working conditions. The site has always been famed for its beauty. On this promontory the great roads from Petersburg to Pittsboro and from New Bern to Greensboro crossed. At the cross was a chapel of the Church of England, giving to the eminence its name, New Hope Chapel. The name "Chapel Hill" occurs in the report of the Trustees, November, 1792, on the choice of a site, and a contemporary account describes the site as follows:

"The seat of the University is on the summit of a very high ridge. . . . The ridge appears to commence about half a mile directly east of the building, where it rises abruptly several hundred feet. This peak is called Point Prospect. The flat country spreads out below like the ocean, giving an immense hemisphere in which the eye seems lost in the extent of space."

This account is equally valid to-day. The region abounds in hills, covered with magnificent trees, filled with springs and brooks, and with a profusion of mountain flowers. The campus, of about fifty acres, is one of the most beautiful in America. The University owns, contiguous to the campus, five hundred acres of forest lands, partly laid off in walks and drives. Plans are under way for the development of part of this tract, to be called South Campus, on which new quadrangles are to be erected in the near future.

The present buildings of the University, about twenty-five in number, range in age from the magnificent new Phillips Hall, just completed, to Old East, dating to 1795. There is a central heating and lighting plant. There is also a filtration plant, guaranteeing abundance of pure water. The Infirmary is a modern building, completely equipped, and under the direction of the University Physician. Records prove that health conditions at the University are excellent.

Special Advantages

In addition to the opportunities afforded by the courses of instruction and by library and laboratory equipment, members of the Graduate School have special privileges of great value.

Several endowed lectureships are maintained by the University. The McNair Lectureship, founded in 1906 by the will of John Calvin McNair of the class of 1849, provides for an annual series of lectures by a visiting scholar of distinction, and for the publication of the lectures in book form. Among the holders of this lectureship in recent years have been Dr. David Starr Jordan, of Stanford University; Dr. Henry Van Dyke, of Princeton; President Arthur Twining Hadley, of Yale; Professor Francis G. Peabody, of Harvard; Dr. George Edgar Vincent, of Minnesota; Professor John Dewey, and Dean Frederick J. E. Woodbridge, of Columbia, and Professor Hugh Black, of Union Theological Seminary.

The Weil Lectures in American Citizenship, founded by Mr. Sol Weil and Mr. Henry Weil, of Goldsboro, were inaugurated by former President William Howard Taft in 1914-1915. The series for 1915-1916 was given by Professor George B. McClellan, of Princeton, and recent lectures have been given by Mr. James A. Macdonald, of Toronto.

A Southern exchange lectureship is also maintained, by which members of the faculties of Vanderbilt, the University of Virginia, and the University of South Carolina, in annual succession, spend a week at this University during which time they offer public lectures and meet certain groups of students for intensive study.

In the Division of Languages and Literatures a special seminar is offered in each year, under the direction of a distinguished scholar from some other university. The Seminar meets daily for a week, each session continuing for two hours. It is open only to advanced students in the Division, who are supplied with a syllabus, and are expected to do some preliminary reading in the subject before the regular sessions begin. This makes possible an intensive study, by a small group, of a subject limited in its scope and conducted under such conditions as to render possible the intimate association of the class-room. Professor J. E. Spingarn, formerly of Columbia University, was the first incumbent on this foundation, his subject being Literary Criticism. Professor Edwin Mims, of Vanderbilt, followed Dr. Spingarn, his subject being National Ideals in American Literature. In 1918-

1919 a Seminar in Shakespeare was conducted by Professor Raymond M. Alden, of Stanford University, and in 1919-1920, a Seminar in Pre-Shakespearean Drama by Professor John M. Manly of the University of Chicago.

In addition to these special courses and lectureships, there are in each year many single lectures by well-known men. Some of these are of scholarly nature, others are popular. There are many entertainments of various kinds under the direction of the University. Notable among these are the Sunday evening recitals conducted by the Department of Music, the concerts and recitals by various University musical organizations, and the production of dramatic work by the Carolina Playmakers. These plays are written by students in English 31, and are produced by them, under the direction of Professor F. H. Koch, at the Playhouse.

In the various departmental clubs students engaged in work in special fields find opportunity for the discussion of problems of mutual interest. There are also meetings of the Graduate School from time to time for papers and social intercourse.

ORGANIZATION OF THE GRADUATE SCHOOL

Work for advanced degrees in the University of North Carolina is under the supervision of the Graduate Faculty, which consists of those officers of professorial rank who are chiefly interested in the Graduate School, either because they offer courses for graduate students or because of their interest in research. The immediate direction of the Graduate School is in charge of an Administrative Board, of which the Dean is chairman, consisting of ten members of the faculty who represent the three divisions under which the courses offered by the Graduate Faculty are listed.

These divisions, with the departments constituting each, are as follows:

I. *The Division of Languages and Literature*

The Department of English
The Department of German
The Department of Greek
The Department of Latin
The Department of Romance Languages

II. *The Division of Philosophy and of Political and Social Sciences*

The Department of Economics
The Department of Rural Economics and Sociology
The Department of Education.
The Department of History
The Department of Philosophy

III. *The Division of Mathematics and the Sciences*

The Department of Botany
The Department of Chemistry
The Department of Electrical Engineering
The Department of Geology
The Department of Mathematics
The Department of Physics
The Department of Zoology

General Purposes of the Graduate School

The Graduate School finds its special work in the following fields:

1. It is interested in carrying on research and in training its members in the method of investigation. The University, as an educational institution, is charged with the duty of gathering and organizing the stores of human knowledge and in converting this knowledge to the uses of to-day's life. But it is also charged with the duty of adding to the sum of human knowledge and of training investigators in the method by which learning has been advanced.

All the work of the University which relates to this extension of the bounds of knowledge and to this mastery of the method of research comes within the scope of the Graduate School. To foster in every possible way the spirit of inquiry among the members of its staff of instruction is part of its duty, not only because graduate studies can be conducted only by those who are possessed of this spirit, but also because it is by the presence of this spirit, among instructors and students alike, that the university differs from the fitting school. The Graduate School exerts a powerful influence upon undergraduate instruction, and it also seeks to draw into its ranks all young men and women who are capable of becoming trained investigators. All the company of scholars, therefore, whether professors with many learned works to their credit or beginners who have taken some branch of learning to be their province, are co-workers. Their relationship is more intimate than is possible in the undergraduate department. They form one company, each member of which aids the others in the common cause, the search for truth. Through this relationship the continued advance of learning is made secure.

2. Besides this primary duty of encouraging the spirit of research, of contributing to the sum of knowledge, and of training investigators, the Graduate School must train teachers for secondary schools and colleges. Departmental teaching in these institutions depends, if it is to discharge worthily its function, upon three elements: first, a thorough grasp of the field of learn-

ing represented by the department; second, training in the method of the subject, which means its province, its organization, and the discovery of problems and their solution; and, third, the relation of the department to the entire field of education and to life. The Graduate School offers to those of its members who expect to become teachers opportunity for the thorough professional training indicated by these requirements. The method of research will be used not because it is necessary that the departmental teacher be a productive scholar in the technical sense but because it is necessary that he shall be a scholarly man who is able to produce, through his training and character, something of the spirit of scholarship in others. The present agitation about the pay and influence of teachers will result not only in improved conditions but also, through the elimination of the unfit and of those who teach for a year or two on their way to another occupation, in the development of such standards as really to make teaching a learned profession of equal rank with law and medicine. In the greater emphasis on training, on learning, and on the qualities of the scholar certain to result from this movement, the Graduate School finds larger opportunities as a professional school.

3. In addition to these two functions which make it a professional school of equal authority with the other professional schools of the University, the Graduate School differs from these other professional schools in that it preserves a unique relation to the undergraduate college of arts and sciences. As a professional school, it trains investigators and teachers. As a continuation of the undergraduate college it supplements and corrects the elementary course.

Many young men and women feel, at the close of their undergraduate course, that they are just ready to begin what might prove their real education. Despite the pressure of modern life, the impulse to go at once into business or to enter upon the course in law or medicine, it is certain that this desire for a year or two more of liberal culture will become increasingly influential with men and women who are conscious of high gifts. Indeed, the very pressure of modern life itself, the increased competition

for the prizes of life, will make such further study desirable even from the standpoint of material success. Such students will enter the Graduate School not to become investigators or teachers in special fields but to secure a co-ordination and summary of their undergraduate course in a way impossible through other means. The task of the undergraduate college is to introduce the student to the great knowledges, or fields of learning. The task is so immense and the handicaps of modern college life are so great that the senior realizes vividly that he has acquired only elements and perhaps a taste for higher study by the time he must leave the college. In the Graduate School, while his purpose will be to concentrate somewhat more rigorously upon one division of learning, he will find greater freedom for reading and individual study, greater opportunity for cultivating some taste to the point of relative mastery, and a clearer view of the relation of learning to life. Such students will find it possible to plan the courses they want in such a way as to make the winning of the Master's degree a real aid to a rich and fully developed life. The ideal, for students of this type, is not the highly specialized work leading to the doctorate, but a course, and a method of study, planned along the lines of the tradition of the great English universities, Oxford and Cambridge.

The Departments and the authorities of the Graduate School of the University of North Carolina will pay particular attention to the needs of the students who are attracted by the possibilities described in this section.

4. Lastly, the Graduate School offers opportunities for certain forms of special training not included under the three preceding classifications. Some of these special trainings are described under the various departmental statements below. The field of community service, in various aspects, is covered, on its practical side, by courses in the Department of Rural Social Science and in the School of Commerce; and on the creative side by training in community music and community drama. Again, while at present the School of Commerce is not a graduate school, it is expected that this side of its work will be developed, and even now, some of its courses should prove attractive to young men

who hold the Bachelor's degree and would profit by a year or two of special work in business subjects before entering the field of commerce to which they expect to devote their lives. Courses in higher economics, in business administration, in foreign trade relations, combined with courses in other departments chosen for their contribution to a wider business knowledge and the development of sound business judgment may be planned in such a way as to make the Master's degree worth while. Other illustrations of the way in which the Graduate School may assist through affording training for special pursuits will occur to anyone. For example, a year's work preparatory to journalism is offered to college graduates. A year's work preparatory to law is offered by the combination of courses in History and Government, Sociology, and Economics. The Dean of the Graduate School and the Administrative Board will be glad to plan such special courses for any properly qualified candidate who may apply.

ADMISSION AND OTHER INFORMATION

Admission

Holders of Bachelor's or Master's degrees from standard colleges are admitted to the Graduate School upon presentation of their credentials and without examination. Upon the vote of the Administrative Board other mature persons may be admitted as special students in courses for which they are qualified. Every student must bring to the office of the Graduate School, at the time for registration, a program of studies approved by the Department in which he proposes to specialize, or, in the case of special students, the permission of the Department to register for certain specified courses.

Not earlier than the last week of his first quarter of residence, a member of the Graduate School may apply for admission to candidacy for a higher degree. To do this, three steps are necessary: 1. The applicant must file in the Dean's office a transcript of his undergraduate record in the departments in which he proposes to do his major and minor work, and in allied departments. 2. The heads of the major and minor departments in which the

candidate is working at the University of North Carolina, or their representatives, must certify that the candidate is qualified to carry on such advanced work as may be required for the degree. In case a student lacks certain elementary courses in either the major or the minor department, such courses will be indicated on the departmental certificate, and will become pre-requisite courses without graduate credit. 3. A report on the work done by the candidate during the term or terms in which he has been a member of the Graduate School must be filed by the head of the major department or his representative. This report will cover all the work done at the University of North Carolina and will indicate the department's approval of the application for admission to candidacy for a higher degree.

It should be noted that this distinction between admission to the Graduate School and admission to candidacy for a degree does not necessarily involve any extension of the time required for the degree. Properly qualified students will register at once, with the approval of the departments interested, for such advanced courses as they wish to take, and all advanced courses completed according to the rules for graduate work will be credited towards the degree.

Fees and Expenses

The tuition and incidental fees in the Graduate School are the same as in the College of Liberal Arts, thirty dollars each quarter. But under the act of the Legislature adopted in 1887, free tuition is given to candidates for the ministry, to the sons of ministers, to young men under bodily infirmity, and to teachers in the schools of North Carolina. Young men who agree to teach in North Carolina for at least two years after leaving the University are also exempt from charges for tuition.

A certain number of University Scholarships, carrying free tuition in the Graduate School, are available. Applications for these scholarships should be filed in the office of the Dean not later than April 1st.

University Teaching Fellowships

Eighteen Teaching Fellowships, each with a stipend of $500, are available to graduate students. These Fellowships carry free tuition, and are payable in nine monthly instalments, beginning October 15th of the year for which they are awarded. Holders of these Fellowships are expected to perform certain limited services as teachers or laboratory assistants in the department to which they are assigned. This department must be the major department of graduate study, and each holder of a Fellowship will be required to pursue advanced courses in the department during his term as Fellow.

Fellowships are awarded only to men who present satisfactory records as students and who give promise of being able to carry on advanced work with distinction. Teaching experience is desirable, but is not required. The time required for the Master's degree may be extended in the case of men who hold Fellowships; ordinarily such men will not find it possible to register for more than two-thirds of the program ordinarily carried by graduate students.

Correspondence in regard to the Teaching Fellowships may be addressed to the Dean or to the head of the department in which the candidate proposes to do his major work. A special form of application, to be secured from the Dean's office, must be filed on or before April 1st. Elections to Fellowships will be made by the Administrative Board of the Graduate School, on nomination by the department to which the Fellowship is to be assigned.

Rooms and Board

Graduate students may apply for rooms in University dormitories on the terms named in the catalogue. Rooms are also available in the town. Board costs from $22.50 to $30.00 per month.

The University Year

Three terms, or quarters, of approximately eleven weeks each, constitute the regular University year. In addition, a summer session of six weeks extends from the last of June until the first

week in August. In all of these terms graduate courses are offered, and students may register at the beginning of any term.

The unit of work is the course, by which is meant, as a rule, a class meeting five times a week. Half courses are also offered. In some courses open only to graduate students, such as the seminars and other research courses, the formal class exercises are modified. But all such work is credited in terms of courses and half courses.

Students are ordinarily expected to register for three courses. But two half courses may be substituted for a full course. Not more than three courses, or fifteen hours of class attendance, will be permitted. Students of more than one year's standing, candidates for the doctor's degree, are permitted greater latitude with reference to courses for which formal registration is required. Such considerations as the amount of time devoted to research, to work on the doctorate dissertation, and the like, weight in the estimate of what constitutes full work. But in all such cases detailed reports by the Department are required before residence credit is given.

Graduate students who desire credit for attendance at the Summer Session must register at the office of the Dean. The rules respecting admission to candidacy for higher degrees, for selection and approval of courses, and for the higher degrees, are the same in their application to Summer Session students as in the case of students registered for the regular sessions.

Teachers of experience whose credentials and work are satisfactory to the Administrative Board may complete the requirements for the Master's degrees in four summer sessions. Such students will be expected to continue their studies during the year under direction of the special committee in charge of their work, and may do part of the work required for their theses in this manner. In certain approved cases, also, a limited amount of credit may be transferred from work done in another University Summer School. Every such case is treated individually, and must be approved by the Administrative Board, on recommendation of the Department, at the time application is made for admission to candidacy for a higher degree. Students who are

not admitted under these special conditions will find five summers necessary for completion of the requirements for the Master's degree.

Only work announced as open for graduate credit in this Bulletin or the Bulletin of the Summer Session may be counted towards the higher degrees.

Work done *in absentia* will not be counted for graduate credit, except that in certain cases approved by the Department and by the Administrative Board, part of the work on the thesis for a higher degree may be done elsewhere, and except, further, that part of the work required for the degree of Doctor of Philosophy, may, on the recommendation of the major department and with the approval of the Administrative Board, be done at another University. But all such work, even when credited, is subject to examination at the finals required for the degree.

General Regulations

The following regulations of the Faculty of the Graduate School should be observed:

1. Graduate students are subject to the same rules regarding attendance upon classes, faithfulness to assigned tasks, examinations and credit as students in other departments of the University. But graduate work usually pre-supposes a greater amount of time for research in the library or the laboratory, and the student, being more mature, is thrown more upon his own responsibility. For these reasons excessive registration is not permitted. The whole idea of graduate work is comprised in a more intense specialization and therefore more complete investigation than is necessary or wise in undergraduate instruction.

2. Grades for each course completed are reported to the Dean and to the Registrar. These grades are as follows:

"1," which represents work of the highest distinction.
"2," which represents work of high distinction.
"3," which represents work that, while satisfactory, is of fair grade only.

No work falling below the standard represented by the grade of "3" is counted for graduate credit. At least half the work credited for any one year of residence must be of grade "2," or better.

3. Each graduate student works under the direction of a special committee which consists usually of the head of the major department, or of some member of the staff of that department under whom the candidate is doing special work, who serves as chairman, and the other instructors with whom the candidate is registered. At least once in each quarter a report on the quality of all the work done by the candidate is filed by the committee in the Dean's office. The program and plan of study proposed by each graduate student will be approved by the committee after conference with the chairman, and by the Dean.

The effort is made to arouse in the mind of the student a sense that graduate work is not a matter solely of attendance on classes and passing examinations on courses. He must see his work as a whole, and in its relation to a department of learning, not as a set of isolated units. In the more intimate personal relations to his advisory committee, too, he finds values impossible in the undergraduate course. He is a member of a small group; instruction is more nearly personal; he becomes acquainted with the method as well as with the content of learning. To this end, he makes use of laboratories and libraries as instruments of learning. It should be noted, also, that in order to gain these ends, greater freedom is allowed the graduate student than is proper for undergraduates. On entrance to the Graduate School, the candidate for a higher degree selects the department and even the professor who is to have charge of his studies. His program of work is made out upon consultation with this adviser, and is directed by a special committee consisting of his instructors in both major and minor subjects. The regulations of the Administrative Board are applicable only to such matters of general policy as look toward a proper concentration of studies in courses sufficiently advanced to be regarded as of graduate grade, and toward a proper standard of quality as evidenced by such tests as the examinations and the thesis.

THE GRADUATE DEGREES

The degrees under the supervision of the Graduate Faculty are Master of Arts (A.M.), Master of Science (M.S.), and Doctor of Philosophy (Ph.D.).

1. THE DEGREE OF MASTER OF ARTS

Prerequisites

For the degree of Master of Arts the general prerequisite is the completion of a course leading to the degree of Bachelor of Arts in a college or university of standard grade. This course should have included special study in the department in which the graduate degree is sought sufficient in extent to constitute, in the judgment of the department, a proper preparation for the advanced work expected of candidates for the degree. If the undergraduate preparation has been insufficient, departments may prescribe certain preliminary courses before recommending a student for admission to candidacy for a higher degree.

Registration

Nine full courses of advanced character are required for the Master's degree. To complete these courses, at least one full year's residence is required. No course will be counted for the degree unless it appears in this Bulletin or is approved by the Administrative Board for inclusion in the next Bulletin to be issued by the Graduate School. Such courses are of two classes only: those primarily for graduates, and those open to graduates and advanced undergraduates. Courses of this second class are ordinarily open only to students of at least Senior standing.

The Major

Of the nine courses offered by candidates for the degree of Master of Arts, six must be from one department, recognized as the major. But with the approval of the special advisory committee and of the Administrative Board closely allied work in another department, where the relationship of this work to the

special plan of study proposed by the candidate is clear, may be accepted as a part of the major. More than six courses in one department may not be counted except under special conditions approved by the Administrative Board.

The Minor

The remaining three courses, constituting the minor, must be chosen from a department different from the major. But the relation of the minor to the major must be such as to constitute for the entire program of the candidate a clearly defined relationship. Ordinarily, therefore, the minor must be a department in the same division as the major, but this is not necessary if the requirement for a unified program of work is met. For a tabular view of these divisions and the departments composing them, see the section on Organization, above. In certain cases the Administrative Board will permit the minor to be in the same department as the major.

Other Requirements

The method of securing admission to candidacy for the degree and the relation of the candidate to his advisory committee are explained above under the heading of General Regulations.

Ordinarily a reading knowledge of at least one modern foreign language is expected of candidates for the Master's degree. This knowledge must be tested by a special examination given by the language department, and must be certified to before the student is admitted to candidacy for the degree. But the language requirement may be waived if the major department regards it as unnecessary in a special case.

The Master's Thesis

Besides the completion of advanced courses that constitute a unified plan of study, the fitness of the student for the degree is tested in two ways: by a thesis and by oral and written final examinations. The thesis tests the candidate's knowledge of the method of investigation and his ability to make use of the knowledge he has acquired. The examinations test his knowledge of

his special field by directing attention to the field as a whole, as contrasted with the course, which deals only with a limited portion of the field.

The subject chosen for the thesis should be approved by the advisory committee and reported to the Administrative Board by the end of the first quarter of residence. No change in subject, or deferring of the time of approval, will be permitted unless at least two quarters of residence intervene between the approval of the subject and the conferring of the degree, except that, with the permission of the Administrative Board, the thesis may be completed by a student not in residence who has satisfied the requirements as to courses. For a statement of the conditions under which such permission may be secured, see above under the heading General Regulations.

The subject of the thesis must be connected with the major, must be connected with a course or courses pursued in residence, and may count not to exceed two courses. No thesis will be approved if it is not written in correct and pleasing English or if it is not presented in scholarly form. It must show independent thought both in its recognition of a clearly defined problem and in its method of treatment. It must show the sources of information and a knowledge of the bibliography of the special field.

The thesis must be presented at least one month before the commencement at which the degree is to be conferred, and in triplicate. The first copy must be on paper of prescribed size and quality, and must observe the special rules of form established by the Administrative Board. A copy of the regulations for the form of theses may be had on application to the Dean's office. A copy of the thesis, when accepted, must be deposited in the University Library. An abstract must be given to the Administrative Board at the time the thesis is submitted for approval; the abstract, if the thesis is approved and the degree conferred, will be printed in a special bulletin of the Graduate School annually devoted to reports of research.

Examinations

Candidates for the Master's degree are required to pass all examinations in courses at the end of each quarter of residence, with the grades specified under the General Regulations above. In addition, two special examinations are required. The first of these is a written examination on the field of the major, is to be set by the student's advisory committee, and must be taken not earlier than the first month of the last quarter of residence. The second examination is oral, covering the entire work of the candidate, both major and minor, with special stress on the thesis and on one other topic to be selected by the candidate. The examination is to be conducted by a special committee appointed by the Dean, consisting as a rule of the student's adviser as chairman and at least four other representatives of the major and minor subjects. Written notice of the time and place for holding this oral examination shall be sent to all officers of professorial rank in the major and minor departments and to the members of the Administrative Board, and persons so notified may attend the examinations if they so desire.

While these examinations are not as rigid as those required for the Doctor's degree, they must satisfy the committee which has charge of them that the candidate possesses such knowledge of his major and minor field as may reasonably be expected, that he can draw upon his knowledge with promptness and accuracy, and that his thinking is not limited to the separate units represented by his courses. Ability to draw conclusions and to express ideas with clearness and precision is a necessary element. No mere memorizing of facts will serve.

The special committees on theses and on the examinations will report their recommendations to the Dean at least one week before the end of the last quarter of residence. If the candidate's record in these respects is satisfactory, and if he has complied with all of the requirements for the degree, the Dean will report to the Faculty for approval and recommendation to the Board of Trustees.

Honors

Honors of two grades. "Honors," and "Highest Honors" may be conferred with the degree of Master of Arts. Recommendations for Honors are made on the basis of the following considerations: 1. The quality of the student's work in the courses pursued in his preparation for the degree. 2. On the thesis, including the style and form in which it is presented, the value of the results, and the quality of thought which it manifests. 3. On the special examinations, written and oral, for the degree. 4. On supplementary reading or investigation outside of course requirements.

Commencement

Degrees are conferred only at the annual commencement exercises of the University in June. But a candidate may complete his required work, including examination and submission and acceptance of the thesis, at the end of any quarter or term. Attendance at the Commencement at which the degree is conferred is required unless the candidate is specially excused by the Dean and the President of the University.

SUMMARY OF THE PROVINCE OF THE DEGREE OF MASTER OF ARTS

The rules and conditions governing the degree of Master of Arts set forth in the preceding paragraphs have certain well-defined aims. It is not a research degree in the sense that the candidate is required to make a contribution to knowledge. It is, however, a research degree so far as the individual student is concerned, since he is engaged in a more detailed study of a single field of learning than was possible during his undergraduate course and this detailed study culminates in work upon a single problem, the subject of his thesis, for the solution of which he is required to give attention to the method of advanced study. He is concerned with the materials of learning, and with the organization and interpretation of these materials. The purpose of his study is still liberal, as in the undergraduate course, but he seeks freedom, not in brief and often unrelated sections taken from the entire field of learning, but in more intensive study of a single

province. To this end, of securing freedom and liberal training along with the greater confidence that is to be gained only through mastery of a sharply defined field, the greatest possible latitude is permitted in study plans. The object is not to train specialists but to gain a relative mastery of one of the liberal arts. Hence the correlation of courses, the oral and written examinations, and the thesis. Since there are many possible combinations of courses, and since the method of administration provides for personal supervision of a student's work by a special committee, the training for the degree is a useful and needed supplement to the undergraduate course.

The work outlined above can be done in one year by students whose preparation has been good and who devote themselves as fully to this more specialized work as they would in a professional school. But two years are better than one, and will yield correspondingly greater results. Especially is this true for young men and women who desire to prepare for high school and college teaching, but who do not wish to become investigators or specialists. Part of their time may be spent in study of courses and programs, and of methods of instruction applicable to their special subjects. Two years of study of this sort, if put on the right foundation, will give rich results, and for some reasons such a course is more useful than the course which leads to the doctorate. The Administrative Board will gladly plan work for the degree of Master of Arts on a two year basis, and persons who complete such a course with distinction will be specially recommended for teaching positions of the better grade.

2. THE DEGREE OF MASTER OF SCIENCE

Prerequisites

The subjects of major study may be Chemistry, Electrical Engineering, or Geology, and the prerequisite courses are the courses leading to the degrees: B.S. in Chemistry, B.S. in Electrical Engineering, and B.S. in Geology respectively. Before becoming a candidate for a master's degree the student must complete the courses leading to the bachelor's degree as outlined in the general catalogue.

Courses Leading to the Degree of Master of Science

I. MASTER OF SCIENCE IN CHEMISTRY

One of the groups: Chemistry 127-128-129
Chemistry 177-178-179
Chemistry 197-198-199

Two of the groups: Chemistry 114-115-116
Chemistry 124-125-126
Chemistry 174-175-176
Chemistry 194-195-196

Three approved courses from one of the following departments:

Electrical Engineering
Geology
Mathematics
Physics

II. MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

Electrical Engineering 100-101-102
Electrical Engineering 110-111-112

Three approved courses from one of the following departments:

Civil Engineering
Chemistry
Geology
Physics

III. MASTER OF SCIENCE IN GEOLOGY

Geology 104-105-106
Geology 107-108-109

Three approved courses in the following departments:

Chemistry
Civil Engineering
Botany and Zoology

Other Requirements

The requirements regarding modern language, thesis, examinations, committee, residence, and conferring of degrees are the same as for Masters of Arts.

3. THE DEGREE OF DOCTOR OF PHILOSOPHY

The degree of Doctor of Philosophy is conferred only upon those who have completed, with high distinction, a period of extended study and investigation in a single field of learning

during which they have gained control of the materials in the chosen field, have mastered the method of advanced study, and have illustrated this method through a dissertation, the result of independent research, which adds to the sum of human knowledge or presents results that have enduring value. Neither the accumulation of facts, however great in amount, nor the completion of advanced courses, however numerous, can be substituted for this power of independent investigation and the proofs of its possession. While it is true that a well prepared student of good ability may secure the degree upon the completion of three years' study, it should be understood that this time requirement is wholly secondary to other considerations that will be explained in the following paragraphs.

Admission and Registration

The rules for admission to courses leading to the degree of Doctor of Philosophy and for registration for courses in the first year of residence are the same as those stated above in the section on the degree of Master of Arts. The work for the first year is substantially the same as that provided for candidates for the Master's degree, and while it is not necessary to take the Master's degree it is usually advisable. The provisions for choice of major and minor subjects, and for the direction of the student's work by a special committee, are as already set forth under the requirements for the Master's degree.

Second and Third Years

Not later than the beginning of the second year's work a tentative program of study must be approved by the special committee and by the Administrative Board. During the second year this program may consist chiefly of advanced courses in both major and minor fields. The minor should be completed during this year. A reading knowledge of French and German, to be certified by the respective departments, is essential to the work of the second year, and in the case of certain subjects other language requirements may be imposed by the special committee. During the second year, also, work on the dissertation should be begun.

Not earlier than the end of the second year, and at least one academic year prior to the Commencement at which the degree is expected, a preliminary oral examination shall be given by the special advisory committee in charge of the candidate's work plus all members of the staff of the major and minor departments. This examination shall cover all the work of the two years. As a rule, no student will be admitted to candidacy for the doctorate until this examination has been passed.

The work of the third year requires no special registration in courses, though the candidate will find it advisable to attend certain courses as a lecture student. The major portion of the time is to be spent upon the dissertation or upon special laboratory or research work, and in preparation for the final examinations. A portion of the second and third years may be spent in residence at another university. In some departments such residence is required, the university being chosen according to the student's need for special courses in the field of his dissertation, or for the library or laboratory facilities it offers. Instead of another university, work in a large library or in some special laboratory may be substituted at the discretion of the student and his advisory committee.

The Dissertation

The subject chosen for the dissertation must be approved by the committee and by the Administrative Board not later than the time of the preliminary examinations. But work upon it, such as preliminary bibliography, collection of material, etc., should be begun earlier than this. The dissertation is the fruit of thorough investigation of a definite problem and finds its value in the scholarly and workmanlike manner in which it is presented, in its contribution to learning, and in the mental power which it displays. By "contribution to learning" is understood not necessarily the discovery of something previously unknown but the presentation of the results of the investigation of a worthwhile problem in such a way as to merit the claim of originality.

The dissertation must be presented, in three typewritten copies, at least six weeks before the Commencement at which the candi-

date expects his degree. It must comply with the rules for form of theses prescribed by the Administrative Board, and abstracts must be supplied as under the rules for Master's theses. A thesis committee, appointed by the Dean, shall examine the dissertation, and no dissertation shall be accepted unless it secures the unanimous vote of the committee.

Publication of the dissertation, except by abstract in the Graduate Bulletin, is not required. But the various journals published by the University afford opportunity for such publication, in whole or part.

The Examinations

Reference has already been made to the preliminary examination required for admission to candidacy for the doctorate.

At least four weeks before the end of the period of study a written examination in the major subject must be passed by the candidate. This examination, which is conducted under the direction of the major department, may be limited to the courses taken by the candidate, but as a rule it is based upon the entire field of knowledge represented by the major.

The final oral examination must take place at least two weeks before the Commencement at which the student is a candidate for the degree. The committee to have charge of this examination is appointed by the Dean, and includes the head of the major department or his representative as chairman, with other members of the major and minor departments as assistants. The date and place of the examination shall be publicly announced, and the examination shall be open to any member of the Graduate Faculty.

Candidates whose record in courses, examinations, and dissertation is satisfactory will be reported by the Dean to the Faculty for recommendation to the Board of Trustees.

Commencement

Attendance at the Commencement at which the degree is conferred is required, unless the candidate is excused by the Dean and the President of the University.

COURSES OF INSTRUCTION

Only those members of the various departmental staffs who are concerned in graduate instruction are included in the following statements.

DEPARTMENT OF BOTANY

William Chambers Coker, *Professor.*
Henry Roland Totten, *Instructor.*

For students well prepared in Botany opportunities are open in teaching, in the scientific work of the United States government and of state institutions, in special work in various phases of the subject such as plant breeding with independent institutions. A Master's degree in botany should prepare the student for positions in any of these fields. A doctor's degree is open to those who have the opportunity to prepare themselves for the more responsible positions. One teaching fellowship of $500 and two assistantships are open to students prepared to fill them.

Laboratory Equipment

The Botanical laboratories are in a well equipped modern building with all the necessary apparatus for the work that is carried on. The library is large and contains a great majority of the important botanical journals as well as thousands of valuable books and reprints. The Arboretum is of much value to students in the study of special problems, and the surrounding country is particularly rich in a great variety of interesting plant life.

The candidate for the degree of Master of Arts is at first given work requiring individual initiative, and a part of his work during the course consists of original work, with the preparation of his results in the form of a thesis suitable for publication.

Candidates for the degree of Doctor of Philosophy give most of their attention to the preparation of an advanced thesis and must show distinct ability to handle their subjects in an orginal manner. A part of their work may be done during the summer at biological stations or other institutions, and visits to other libraries may be necessitated for the study of special literature.

Courses for Graduates and Advanced Undergraduates

3-4-5. Special Morphology of the Fungi with special attention to plant diseases, the culture of the lower fungi, and the identification of mushrooms. Lectures with laboratory and field work. Prerequisite, Botany 1. *Triple course. Fall, Winter, and Spring quarters.* (Credit will be given for any quarter.) Professor Coker and Mr. Totten. These courses may be continued under the same numbers for more than one year as the subject advances, credit being given for each repetition.

Courses Primarily for Graduates

107, 108, 109. Plant Morphology: advanced work in the embryology and anatomy of plants. The student is required to collect and prepare material for the microscopic study of special problems. Theses. *Triple course. Fall, Winter, and Spring quarters.* Professor Coker. These courses may be continued under the same numbers for more than one year as the subject advances, credit being given for each repetition.

110. Original work, with thesis, under the guidance of the instructor. Professor Coker. This course may cover most of the work of the student for several years, credit being given each year in accordance with the work done.

DEPARTMENT OF CHEMISTRY

FRANCIS PRESTON VENABLE, ALVIN SAWYER WHEELER,
JAMES MUNSIE BELL, *Professors.*
JAMES TALMAGE DOBBINS, *Associate Professor.*

The student who wishes to make Chemistry his profession may later wish to enter one of the following branches of the profession: (1) *Teaching in Schools, Colleges, and Universities.* At present the work leading to the degree of B.S. in Chemistry fulfills the requirements of the State, but there is a strong tendency towards the requirement of the Master's degree for the highest grade of teacher's certificate. For teachers in colleges and universities the work leading to the Ph.D. degree should be taken. (2) *For industrial chemists, consulting chemists and chemical experts,* at least the M.S. degree and preferably the Ph.D. should be sought.

The courses leading to these degrees provide also thorough training in the allied sciences, physics, geology, mathematics and engineering, thus enabling the student to become an expert adviser for a corporation in developing and supervising its manufacturing plants, or to act as a consulting chemist in special problems. (3) *The National and State Scientific Bureaus* employ large numbers of chemists and are constantly appealing to the universities for nominations to fill new positions. The better of these positions require candidates with the Ph.D. degree. (4) *Research Chemists* are employed by many private manufacturing establishments and by many semi-public research organizations which maintain thoroughly equipped laboratories. In these, investigations are pursued having for their end the improvement of old methods and the invention of new methods. The number of such laboratories is rapidly increasing and there is now a great demand for highly trained chemists to take charge of these laboratories and to direct their work. The proper training for such a career is the work leading to the Ph.D. degree.

The work of a graduate student who specializes in Chemistry consists in large measure in the solution of some research problem. The student learns at first hand the point of view and the methods of research chemists. At the present time a number of lines of investigation are being actively followed in this laboratory. In inorganic chemistry research is in progress on the compounds of zirconium. In organic chemistry the kelp oils are being studied in co-operation with the National Bureau of Soils. Cymene, a by-product of the wood industry, is being investigated. Work is in progress on juglon, a dye intermediate, and on certain condensation processes of organic chemistry. In physical chemistry the physical constants of the nitrotoluenes are being studied at the request of the National Research Council. The results of all these researches appear as the work proceeds and during the year 1919 about ten articles were published in the American journals reporting progress in these investigations.

The research experience gained in the graduate years is of inestimable value not only to the student himself but also to the educational institution or to the industry with which he later

becomes associated. This is amply verified from the records of the positions held by the graduates of the University. Many have gone into the iron and steel industry, a number into the dye industry either as supervisors of plant operation or as directors of chemical research. Others have gone into other industries, such as tobacco, corn products, general chemicals, and fertilizers. Several alumni are now in charge of large research projects at public and semi-public institutions.

The Department of Chemistry occupies a building constructed in 1905 and located in the eastern portion of the campus. There are two stories and a full basement. It contains forty rooms, among which are three lecture rooms, eight general laboratories, four private laboratories, four research laboratories, four laboratories devoted to special work, a fire-proof room and a constant temperature room. The building has recently been re-wired, greatly improving the lighting system and providing for laboratory work requiring the electric current.

The Chemical Library and Reading Room contains many complete sets of the important chemical periodicals, many books of reference, and a unique collection of books of historical value and interest, amounting altogether to more than 3,000 volumes. The library is maintained by an endowment of $5,000, the generous gift of Mildred Cameron Shepard in memory of her father, Paul Cameron. Recently a valuable collection of journals was purchased, supplementing the already excellent collection. The library has also recently received from Mr. W. R. Kenan four sets of the principal American journals. This collection is available to students and is of inestimable value in research work.

Fellowships and Scholarships

Ledoux Fellowship. This fellowship, awarded annually, is the gift of Dr. A. R. Ledoux of New York. The amount of the fellowship is $300.

Dupont Scholarships. During the year 1919-1920 there are two scholarships of $350 and $400, given by the Dupont Company of Wilmington, Delaware.

Attention is also called to the Teaching Fellowships which are open to graduate students who wish to defray a part of their expenses by teaching elementary classes.

Some assistantships are also open to graduate students. The duties of the assistants are the preparation for and supervision of laboratory classes in the larger elementary courses and also the examination of laboratory reports.

Applications for these positions should be directed to the Department of Chemistry not later than May 1st of each year.

Graduate Degrees in Chemistry

The course leading to the degree of *M.S. in Chemistry* is open to students who have graduated with the degree of B.S. in Chemistry at the University, and to students who have completed the equivalent of the course as prescribed by the University. The course leading to the degree of M.S. in Chemistry is prescribed by the Graduate Faculty and consists of a research in one of the branches, inorganic, organic, analytical or physical chemistry, of two seminar courses of two quarters each in two of those branches, and of two courses of two quarters each to be selected from four departments: Physics, Geology, Electrical Engineering, and Mathematics. The general regulations of the Graduate School govern the work for the Ph.D. degree.

Courses of Instruction

For candidates for advanced degrees with a major in some other department and with a minor in Chemistry, the following courses only are open:

Candidates for the A.M. degree with a major in Chemistry must have elected Chemistry as a major in the junior and senior years. Prerequisites are therefore: Chemistry 1, 2, 31, 41, 42, 11, 12, 13, 61, 62.

Candidates for the degrees of M.S. in Chemistry, and for Ph.D., must have completed the course leading to the degree of B.S. in Chemistry.

Courses for Graduates and for Advanced Undergraduates

11. Industrial Chemistry. The methods and economics of the chemical industries: acids, alkalies, fertilizers, etc. *Fall Quarter.* Professor VENABLE.

12. Industrial Chemistry. The methods and economics of the chemical industries: metals and textiles. *Winter Quarter.* Professor VENABLE.

13. Chemistry of Foods: Digestion processes; and the composition, preservation, adulteration and industrial production of foods. *Spring Quarter.* Professor VENABLE.

18. History of Chemistry: with discussion of the development of chemical theories. *Spring Quarter.* Professor VENABLE.

45. Technical Quantitative Analysis: Fuels and Gas Analysis. *Fall Quarter.* Professor DOBBINS.

46. Technical Quantitative Analysis: Water, Fertilizers, Iron and Steel, Cotton Products, etc. *Winter Quarter.* Professor DOBBINS.

62. Organic Chemistry. Carbocyclic Series. *Fall Quarter.* Professor WHEELER.

63. Identification of Pure Organic Compounds. *Spring Quarter.* Professor WHEELER.

64. Advanced Organic Chemistry. Reports on assigned topics with conferences. Library Work. *Winter Quarter.* Professor WHEELER.

81. Physical Chemistry. Study of the properties of solids, liquids and gases, and of their relation to chemical constitution. *Winter Quarter.* Professor BELL.

82. Physical Chemistry. The theory of solutions. *Spring Quarter.* Professor BELL.

83. Physical Chemistry. The methods of physical chemistry as applied to industrial processes. *Fall Quarter.* Professor BELL.

84. Physical Chemistry. Electrochemistry. *Spring Quarter.* Professor BELL.

Courses Primarily for Graduates

114, 115, 116. Advanced Technical Chemistry. Seminar Course: readings and discussions of recent advances in Tech-

nical Chemistry. This course extends throughout the year. Professor VENABLE.

124, 125, 126. Advanced Inorganic Chemistry. Seminar Course: readings and discussions of recent advances in Inorganic Chemistry. This course extends throughout the year. Professor VENABLE.

127, 128, 129. Research in Inorganic, Analytical and Industrial Chemistry. This course (or 177, 178, 179 or 197, 198, 199) is intended for applicants for advanced degrees. Laboratory work with frequent conference with the professor and reference to the literature relating to the subject of research. The subject of research must be assigned or approved by the professor. This course extends throughout the year. Professor VENABLE.

Laboratory fee, $10.00 a quarter.

174, 175, 176. Advanced Organic Chemistry. Seminar Course: readings and discussion of special chapters in Organic Chemistry. This course extends throughout the year. Professor WHEELER.

177, 178, 179. Research in Organic Chemistry. The statements made in regard to Courses 127, 128, 129 apply also to this course. Professor WHEELER.

194, 195, 196. Advanced Physical Chemistry. Seminar Course: readings and discussions of recent advances in Physical Chemistry. This course extends throughout the year. Professor BELL.

197, 198, 199. Research in Physical Chemistry. The statements made in regard to Course 127-128-129 apply also to this course. Professor BELL.

The Journal Club meets fortnightly. The current journals, American, English, German and French, both the purely scientific and the technical, are reviewed by the students and instructors. Attendance of students in advanced courses is expected.

DEPARTMENT OF ECONOMICS AND FINANCE

CHARLES LEE RAPER, DUDLEY DEWITT CARROLL, *Professors.*

The opportunities open to the student who is trained in Economics and Finance are numerous: (1) High Schools are very generally offering courses in Economics. Colleges and Normal

Schools almost without exception have a need for trained teachers of Economics. (2) Taxation (State and National) has become so important that there are many calls for trained students to aid the tax-payer and the government. (3) Business has become so complicated in many of its phases that there is coming to be a large need for the trained economist as an aid for the business man.

The Department of Economics and Finance has a teaching staff which is interested both in teaching and in research. It has the important economic and financial journals (American and European). It has an adequate supply of books and documents.

The Department offers one graduate degree, that of Master of Arts. A candidate for this degree should devote two-thirds of his time to the courses in Economics and Finance; his other courses must be in a closely allied department.

Courses for Graduates and Advanced Undergraduates

3-4. Money and Banking. A general study of the principles, functions, and forms of money, credit, and banking; a special study of current money, credit, and banking problems. *Double Course. Fall and Winter Quarters.* Professor RAPER.

6. Insurance. A general study of the principles and methods of property, social (for industrial wage earners), and life insurance; a special study of life insurance. *Spring Quarter.* Professor RAPER.

9. Transportation. A general study, from the historical and critical points of view, of railway transportation in such representative countries as Great Britain, France, Italy, Germany, and the United States; a special study of passenger and freight traffic and rates; a special study of the state's relation to the railways. *Fall Quarter.* Professor RAPER.

10. Labor Problems. A study of labor as a factor in the industrial process; of the wage system and employment problems; of immigration and poverty; of labor organizations, strikes, lockouts, arbitration, factory legislation, and industrial education. *Half Course. Spring Quarter.* Professor CARROLL.

13-14. Public Finance. A general study of the principles which are involved in the revenues and expenditures of the state, and in the relation of the state to the industries of its citizens; a special study of taxation—local, state, and national. *Double Course. Winter and Spring Quarters.* Professor RAPER.

16. Theories of Economic Reform. An analysis of the leading proposals for reform in the present Economic system, including Socialism, Bolshevism, Labor Co-Partnership, and Industrial Democracy. *Half Course. Fall Quarter.* Professor CARROLL.

For courses in Accounting, Business Organization and Management, and Commerce, see the Bulletin of the School of Commerce.

DEPARTMENT OF EDUCATION

MARCUS CICERO STEPHENS NOBLE, LESTER ALONZO WILLIAMS, EDGAR WALLACE KNIGHT, JOHN FREDERICK DASHIELL, *Professors.*

Primarily it is the function of the Department of Education to train teachers and administrators for the public schools. It is no less its function to inform students whose primary interest lies in other fields concerning the place and function of the public school as a necessary instrument in a democracy.

As a consequence there are offered in this department three distinct types of courses: (1) those strictly professional in nature, (2) those intended to assist other departments in placing students of those departments as teachers in the public schools of the state, (3) those which are more general and cultural in nature but presented from the pedagogical viewpoint.

The Department of Education is centralized in the Peabody Building, a gift from the George Peabody Fund, equipped with recitation rooms, offices, laboratories, a reading and seminar room.

It has entered into active co-operation with the local school board by which the elementary and secondary units of the local school system are open for the use of faculty and students in the department.

In like manner the rural schools in Orange County are always available for observation and study by faculty and students. This arrangement includes the Orange County Training School for

Negroes, affording ample opportunity for a study of this rapidly developing project of the State Department of Education.

The University Library contains an excellent collection of text-books on the theory and practice of pedagogy in the fields of principles, methods, and history. Text-books in the subject matter usually taught in the public schools both present and past offer an interesting field of investigation and study. Here also are found current numbers of a score or more of the best educational magazines the back files of which are being completed as rapidly as possible and several of which are already complete.

The requests for visitation, inspection, and assistance which come to the department from all over the state offer many opportunities for the students in this department to participate in survey and investigative activities which are most interesting and valuable additions to and variants from the investigations demanded as course requirements.

The High School Journal, published eight times a year, offers a medium through which acceptable investigations, studies, and occasional papers of students in the department are put forth in printed form, reprints of which may be secured for a nominal fee. Since this magazine goes to schoolmen in every state and to the libraries and departments of education of practically all the leading colleges, universities, and normal schools, an inducement is thus offered to students in the department to do work acceptable not only to the instructors in the courses but as well to fellow members of the teaching profession.

The Work of the Department of Education

The Department of Education provides teachers, principals and superintendents for elementary and secondary schools in every county in the state.

It conducts teachers' meetings, sends lecturers for educational and community meetings upon request and payment of actual expenses.

Using certain of the standard tests and scales it has carried on for three years a plan of co-operative research dealing with

the measurement of classroom products in more than thirty systems of the state.

It has recently been made a Research Station of the United States Bureau of Education and thereby is in continuous and intimate touch with the problems of public school work in a large national way. Two investigations are now under way and several more are under consideration and revision.

It has conducted one city and one county-wide school survey and published the results in bulletin form. It is now engaged in conducting two more similar surveys through the members of its faculty and its students.

Upon request it has advised with school officials upon such matters as the location, specifications and construction of school buildings, the conduct of school bond and special tax campaigns, placement and promotion of teachers and pupils, consolidation of districts, business organization of schools and scores of more detailed problems connected with the public schools.

One member of its faculty has for many years been Director of the University Summer School for Teachers, which has grown in number of students from less than a hundred to more than a thousand and has extended its influence to every corner of the state. Courses of both graduate and undergraduate grade are offered in the Summer School thus making it possible for teachers in service to earn credits towards either the A.B. or the A.M. degree.

In general the Department of Education strives to interpret and serve the needs of the public schools of the state in so far as its resources will permit.

Courses for Graduates and Undergraduates

24-25-26. Foundations of Education in the South. In this course the various educational agencies will be studied by texts, lectures, special investigations, reports, and discussions, for the purpose of presenting (a) the development of present educational practices, tasks, and tendencies, and (b) the influence of the dominating economic, political, and social ideals in the evolution of the free common school system, high schools, and institutions

of higher education. *Full Course,* continuing through the three quarters. Professor KNIGHT.

27-28. American Public Education. A study of the growth of popular education in the United States, of the creation of public sentiment in favor of the education of all the people at public expense and of the gradual realization by the state of the obligation to educate its citizens and how the obligation has been met. *Half Course. Fall and Winter Quarters.* Professor NOBLE.

31-32-33. Rural School Organization, Administration and Supervision. This is an administrative and professional course and is intended for those persons who are preparing for county superintendencies and rural school supervisory positions. It is both a descriptive and research course in rural life conditions in the South and especially in North Carolina, and consists of lectures, discussions, readings, and individual projects in field work and investigation. *Full Course,* continuing through the three quarters. Professor KNIGHT.

40. The Psychology of Training. An analysis of human training: its nature, means, and possibilities. A reading survey will be made of the outstanding experimental work on these lines. The aim will be to get an accurate and scientific notion of the subject, with applications to education. *Half Course,* three hours weekly. *Spring Quarter.* Professor DASHIELL.

41-42-43. Experimental Educational Psychology. Opportunity will be offered for the experimental investigation of special problems along the line of the individual student's interests. Where necessary, adjustment of the work to the needs of graduate students lacking laboratory training in this field can be made. *Half or Full Course,* 5 or 10 laboratory hours weekly. *Fall, Winter, and Spring Quarters.* Professor DASHIELL.

Courses Primarily for Graduates

101. *Administrative Problems.* In this course the more important specific problems having to do with public school administration will be taken up and studied in considerable detail. The amount of time devoted to any one problem will depend largely upon the importance of the bearing of that problem on our local

situation. Since the problems to be considered will vary from term to term and from year to year the course may be taken more than once by the same student. *Full Course.* Professor WILLIAMS.

(The class will meet once each week for two hours through the year.)

102. *American Educational Ideals.* A comparative study of the educational ideals of church, state, and nation in the United States, and of the gradual extension of the field of educational activity by the state as well as by private and denominational institutions. *Half Course. Winter and Spring Quarters.* Professor NOBLE.

103. The Junior High School. A study in detail will be made of the Junior High School, its development, purpose, organization and curriculum. *Half Course. Spring Quarter.* Professor WILLIAMS.

104, 105. Educational Measurements. The course will consider such topics as educational statistics, the derivation of intelligence and subject-matter tests, the general public, and statistical data, the use of tests and scales by supervisors, etc. The undergraduate course in educational measurements is a prerequisite. *Half Course. Fall and Winter Quarters.* Professor WILLIAMS.

106. Public Education in the South. This is a strictly research course in public school education in the Southern States. An exhaustive study will be made of special topics through investigations, reports, and conferences. *Full Course* through the three terms. Professor KNIGHT.

DEPARTMENT OF ELECTRICAL ENGINEERING

PARKER HAYWARD DAGGETT, JOHN HARRIS MUSTARD,
JOHN EMERY LEAR, *Professors.*

The Department of Electrical Engineering offers courses leading to the degree of Master of Science in Electrical Engineering. The requirements for the degree are in general the same as for the degree of Master of Arts and the prescribed courses may be found on page 34. Admission to candidacy for this degree pre-

supposes the completion of the regular four-year course of this University leading to the degree of Bachelor of Science in Electrical Engineering. In the case of students from other technical schools of recognized standing certain substitutions may be accepted in lieu of the specific requirements for the Bachelor's degree here.

The degree may ordinarily be obtained in one year after the conferring of the Bachelor's degree, but in certain cases where the preliminary training of the candidate has been insufficient two years may be necessary.

With the opening of the new laboratories in the Phillips Building the department is able to offer excellent advantages for advanced work in laboratory investigation and engineering design. The laboratories comprise a total of nearly seven thousand square feet of floor space divided into a large dynamo laboratory containing over forty generators, motors and transformers; a standardization laboratory equipped with a wide range of precision standards for both direct and alternating current measurements; a well equipped photometric laboratory; a radio laboratory and a special research laboratory equipped with a complete General Electric oscillograph outfit.

All of these laboratories are supplied with direct and alternating current power by means of a plug and socket system of connections, eight wires running from a large slate switchboard in the main laboratory to sub-panels located conveniently in the smaller rooms. A 120-volt 240-ampere-hour storage battery is available for work where a steady voltage is necessary.

The University Power Plant offers excellent additional facilities for commercial testing and economic study of an advanced nature.

Through the generosity of Captain Isaac Edward Emerson, of Baltimore, the department possesses a very fine library of well chosen text and reference books in both Electrical and Mechanical Engineering, as well as files of the leading electrical engineering journals, American and foreign, some of which are complete to date.

Investigations already undertaken or in contemplation include the end-ring leakage reactance of squirrel cage induction motors, current wave-shapes in the three-wire generator, automatic signalling for local-battery telephone systems and brush drop phenomena.

At present the department is engaged in making a study for the State Highway Commission of the efficiency and operating costs of farm lighting sets.

Courses for Graduates and Advanced Undergraduates

40-41-42. Special Studies in Electrical Machinery. A comparative study of commutation, armature reaction, regulation, etc., in direct and alternating current machinery. Prerequisite, E.E. 1-2-3 or 30-31-32. *Triple Course. Fall, Winter and Spring Quarters.* Professor DAGGETT.

Laboratory fee, $3.00 a quarter.

43. General Electrical Engineering. Power, Transmission; Telephone and Telegraph Engineering. Prerequisite, E.E. 1-2-3 or 30-31-32. *Half Course. Fall Quarter.* Professor LEAR.

Laboratory fee, $3.00.

44. General Electrical Engineering. Radio Engineering; Illumination and Photometry. Prerequisite, E.E. 1-2-3 or 30-31-32. *Half Course. Winter Quarter.* Professor DAGGETT.

Laboratory fee, $3.00.

45. General Electric Engineering. Railway Engineering; Storage Batteries. Prerequisite, E.E. 1-2-3 or 30-31-32. *Half Course. Spring Quarter.* Professor LEAR.

Laboratory fee, $3.00.

46-47-48. Generation, Transmission, Distribution and Utilization of Electrical Energy. An advanced course for students who have not majored in Electrical Engineering. Prerequisite, E.E. 1-2-3 or its equivalent. *One and a Half Courses. Fall, Winter and Spring Quarters.* Professors DAGGETT, MUSTARD and LEAR.

Laboratory fee, $3.00 a quarter.

Courses Primarily for Graduates

100-101-102. Electrical Engineering Seminar. Readings and discussions of recent advances in Electrical Engineering. *Triple Course. Fall, Winter and Spring Quarters.* Professors DAGGETT, MUSTARD, and LEAR.

110-111-112. Electrical Engineering Research and Design. The study of one or more definite problems in some particular field of Electrical Engineering. *Triple Course. Fall, Winter and Spring Quarters.* Professors DAGGETT MUSTARD, and LEAR.

DEPARTMENT OF ENGLISH

EDWIN GREENLAW, FREDERICK HENRY KOCH,
JAMES HOLLY HANFORD, NORMAN FOERSTER, *Professors*
GEORGE MCFARLAND MCKIE, JOHN MANNING BOOKER,
Associate Professors.
HENRY MCCUNE DARGAN, CLARENCE ADDISON HIBBARD,
Assistant Professors.
JAMES STRONG MOFFATT, *Instructor.*

The Department of English offers to graduate students work in the following fields: (1) Research leading to advanced degrees, with the training afforded by specialized courses in literature; (2) preparation for teaching English; (3) special study of the drama, including dramatic composition and training for work in community drama.

1. Intensive study and research are made effective through advanced lecture courses and the seminars, through the resources of a well-equipped library which is developing rapidly, and through the stimulus of association with men who are actively interested in research. There is an excellent seminar room, equipped with reference books and space for individual use of advanced students, which gives convenient access to the book stacks of the general library. The library is especially strong in the field of old and middle English and in the literature of the sixteenth and seventeenth centuries. Besides its share of the annual library appropriation, the Department has the income from the Armfield Fund, which is applied exclusively to the purchase of books for advanced study. Students have also the privi-

lege of membership in a club devoted to research. Besides the large number of special lectures given each year at the University, many of which relate directly to the advanced study of literature, graduate students have the privilege of membership in the special seminars, or short intensive courses in a limited field, which are conducted each year by distinguished scholars from other universities.

2. Besides the advanced courses, which afford opportunity for gaining that sound and accurate knowledge that is the first essential of good teaching, the attention of teachers of English and of those who are preparing for such work is directed toward the development of an effective method. Such students have an opportunity to observe the methods of teaching and administration employed in the large undergraduate courses in English. Certain experiments in teaching these courses are now being tested; graduate students observe these experiments and discuss them with the instructors. The seminars include the study of method in their work, and there is also specific study of the high school and elementary college courses. The new and larger opportunities brought to teachers of English at the present time render this side of graduate study attractive and important.

3. In addition to the intensive study leading to the doctor's degree and the special preparation for teaching English, there are opportunities for work in specific fields,, such as the drama, with a somewhat different point of approach. North Carolina is rich in dramatic materials, and the Department is interested in the possibilities for treatment that these materials present, not only in the development of a native drama but also as a means for contributing to community welfare. In the course in dramatic composition, in the work of the Carolina Playmakers, and in extension work in community drama, advanced students find a field of constantly increasing interest.

Requirements for Advanced Degrees

Candidates for advanced degrees in the Department of English must have completed, before admission to candidacy, a sufficient number of undergraduate courses in English to constitute a major.

The courses elected by a candidate for the Master's degree must include either English 141, or two courses from the seminars 121, 132, 133. The other courses may be chosen from the group designated as courses for graduates or from those designated for graduates and advanced undergraduates. The minor must be chosen from some other department in the Division of Language and Literature, or, in special cases, from a department in some other division; but the plan of work as a whole must be closely unified, and no department may be chosen as a minor unless the candidate has previously completed, as an undergraduate, an amount of work in that department sufficient to constitute an undergraduate minor.

An oral examination on all the work, both undergraduate and graduate, done in the major and minor departments is required for the Master's degree. A thesis which shows knowledge of the method of investigation and ability to make use of the results of such investigation, is required for the Master's degree. A reading knowledge of at least one foreign language is usually required for the degree. Candidates whose oral examination and thesis show unusual power may be awarded the degree with distinction, honors of two grades, "Honor" and "Highest Honor" being recognized. Students who desire the special recommendation of the Department for teaching positions of the better grade are required to acquaint themselves with the work done in the required undergraduate courses for Freshmen and Sophomores and to gain a first hand knowledge, in courses or through private reading, with the major works of English literature. Such students will usually find it advisable to spend two years in preparation for the Master's degree, unless their undergraduate work in English has been very extensive and thorough.

For the degree of Doctor of Philosophy the same general procedure is followed, except that after the first year of study less attention is paid to credit gained for courses and more stress is put upon independent work. But for either degree the greatest amount of latitude is permitted and a variety of possible programs is offered. The test, in both cases, is of mastery of the field as a whole, rather than the securing of a certain number of credit hours.

Courses for Graduates and Advanced Undergraduates

34-35-36. Dramatic Composition. A practical course in playwriting. The method is frankly experimental, the one-act form being the working basis of the course. The essentials of stagecraft—settings, lighting, costumes, and make-up—as applied to dramatic production are illustrated in the staging of original plays by The Carolina Playmakers. *One and one-half Courses.* Professor KOCH.

41. The English Renaissance. The political and literary background of the English Renaissance, including the study of classical learning and medieval literature and thought influential during the period, with some consideration of the Italian Renaissance. The chief readings are in Spenser and his contemporaries. *Fall Quarter.* (Given in 1919-1920 and in alternate years.) Professor GREENLAW.

42. The English Renaissance. A study of the works of Bacon, with emphasis on his relation to educational and political theory and his contribution to scientific method. *Fall Quarter.* (Given in 1920-1921 and in alternate years.) Professor GREENLAW.

43-44. The Elizabethan Drama. A brief study of the beginnings of the English drama, followed by an intensive study of the period from Lyly to the closing of the theaters. While the method of the course is historical, stress is laid upon ideas rather than technique. The works of Shakespeare and his contemporaries form the basis for the study of certain aspects of Renaissance thought and for constant application of these ideas to life. *Double Course. Winter and Spring Quarters.* Professor GREENLAW.

45. Milton. The works of Milton are studied in the light of the life, times, and culture of the poet, with some consideration of the literary problems which are involved in such a study. Class reports and a thesis or essay are required. *Winter Quarter.* Professor HANFORD.

47-48. English Life and Thought in Eighteenth Century Literature. A survey of English literature from 1660 to 1780, emphasizing (1) changes in national life and manners; (2) the growth of philosophic and political systems; (3) certain characteristic

literary forms, such as comedy, the essay, and the novel. *Double Course. Fall and Winter Quarters.* (The Winter Quarter will not be given in 1920-1921.) Professor DARGAN.

56. Victorian Literature: Advanced Course. The work of the course will be in the literature that reflects the English political, economic, social, and religious thought of the age that raised the main questions now facing our own generation. *Spring Quarter.* (Given in 1920-1921 and in alternate years.) Professor BOOKER.

60. American Literature. A more advanced course for members of English 59 who desire to study intensively the work of Franklin, Emerson, and Whitman. *Spring Quarter.* Professor FOERSTER.

68. Comparative Drama. A general survey of the drama and the theater from Aeschylus to Ibsen. The history of the stage and the development of dramatic literature is studied through representative plays (in translation) of the leading European dramatists. *Winter Quarter.* Professor KOCH.

69. Comparative Drama. A survey of the European drama from Ibsen to the present time through selected plays. Special attention is given to the new technique and to the function of the drama in interpreting modern thought and changing social conditions. *Spring Quarter.* Professor KOCH.

81. Old English: Introductory Course. A careful study is made of Old English grammar and syntax, and the language of the older period is considered in its relation to present-day English. A considerable amount of Anglo-Saxon is read. *Fall Quarter.* Dr. MOFFATT.

83. Chaucer. No previous training in Old or Middle English is required. The work of the course will consist chiefly of a reading and discussion of Chaucer's works, with only so much of grammar and syntax and of other reading as will be necessary for an understanding and appreciation of Chaucer. *Spring Quarter.* Dr. MOFFATT.

84. Middle English Literature: Exclusive of Chaucer. The main purpose of the course is to acquaint the student with the social, political, and religious background of mediæval England.

A fuller study will be made of the historical and philological relations of Middle English than in English 83. *Fall Quarter.* (To be omitted in 1920-1921.)

Courses Primarily for Graduates

101. Beowulf. *Winter Quarter.* Dr. MOFFATT.

110. Spenser and His Age: Special Topics. Prerequisite, courses 41 or 42. Professor GREENLAW.

112. Studies in Seventeenth Century Literature. Special problems in relation to Milton and his contemporaries. The course pre-supposes English 45 or an equivalent. *Two Half Courses. Winter and Spring Quarters.* Professor HANFORD.

117. Aspects of the Romantic Movement. This course is a continuation of English 51 for students who wish to pursue a more systematic study of the origins and development of the Romantic Movement. It includes consideration of the continental relations of English Romanticism, an analysis of its various elements, and a discussion of the classical and romantic ideals of art. This course assumes a knowledge of the materials of English 51 but may be taken independently by properly qualified students. *Spring Quarter.* Professor HANFORD.

121. Seminar: Criticism. This course will aim (1) to relate to the wisdom of the past representative contemporary solutions of some problems of modern thought, (2) to foreshadow the necessary tendencies of literature and thought in the future. Emphasis will fall on the religious, philosophical, and ethical aspects of the literature studied. *Fall Quarter.* Professor FOERSTER.

132-133. Seminar: The principles and method of the higher study of English. A general introduction to advanced study of English with a series of simple problems in bibliography, literary history, and criticism. Near the end of the second quarter there will be a study of the method and content of the English course in High Schools and in elementary college courses. *Two Half Courses. Winter and Spring Quarters.* Professor GREENLAW.

141. Seminar: Research in a special field under the direction of a member of the Department.

DEPARTMENT OF GEOLOGY

COLLIER COBB, JOSEPH HYDE PRATT, WILLIAM FREDERICK PROUTY,
Professors.

To men entering the profession of Geology opportunities for useful employment are open in teaching, in state and national bureaus and surveys, in mining, in investigating oil fields, in working various economic geologic deposits, and in soil investigation. Preparation for this work may be had through the regular college course, with Geology as the major study throughout the course, and the addition of field-work in vacation and work in the Graduate School for one or more years. It may also be obtained through a course in the School of Applied Science leading to the degree of Bachelor of Science in Geology; and this should in every case be followed by work leading to the degree of Master of Science as outlined below.

The work of the graduate student specializing in Geology should be, in large measure, the investigation of problems in the field, and the working out of many of the details in the laboratory. At the present time the following lines of investigation are being pursued by members of the Department of Geology: mineral analysis of seashore sands and their value as a source of economic minerals, mineral analysis of soils in relation to soil fertility, shore-line processes in relation to harbor development, a study of mineral fertilizers, stratigraphy of the Alabama Silurian, the character and location of road materials in relation to highway construction in North Carolina.

The Geological Laboratory and Museum

The Geological Laboratory occupies the first floor of the New East building. In addition to a lecture room with a seating capacity of about fifty, there is a large laboratory supplied with working collections of minerals, rocks, and fossils, and with photographs, maps, and models illustrating geological structure. The laboratory is furnished with three petrographical microscopes, with four microscopes for soil study, and with apparatus for the slicing and polishing of rocks. Microscope slides have been made of most of the specimens from North Carolina; the department

has, also, sections of the typical European rocks. Sections of the rocks around Chapel Hill, and the igneous rocks of the Boston Basin, made by the late Hunter Lee Harris, of the class of 1889 were given to the geological department. There is a room for photographic work.

Graduate Degree in Geology

The course leading to the degree of *Master of Science in Geology* is open to students who have graduated with the degree of Bachelor of Science in Geology in this University, and to students who have completed the equivalent of the course as prescribed by the University. The course leading to the degree of M.S. in Geology consists of a special research course in some one branch of Geology, pursued throughout the year, and a field course to which six weeks of field-work is devoted in the summer under the direction of a member of the graduate faculty, followed up by the completion of the investigation during the fall term. These researches constitute six full courses for the Master's degree. In addition to this major, the candidate must complete three approved courses in the following departments: chemistry, civil engineering, zoology and botany.

Courses for Graduates and Advanced Undergraduates

8-9. Stratigraphy: lectures, with laboratory work and field work, conferences and theses. *Double Course. Fall and Winter Quarters.* Professor PROUTY.

Laboratory fee, $5.00 a quarter.

10-11-12. Economic Geology: ore deposits, coal, oil and gas, clays, building stones, cement materials, fertilizers, underground waters, etc.; occurrence, methods of exploitation, production, and conservation of mineral resources; lectures, laboratory and field work. Prerequisite, Geology 1-2 and Chemistry 1-2. *Half Course each Quarter.* Professor PROUTY.

Laboratory fee, $2.00 a term.

13-14. Petrology and Petrography: rocks and rock minerals, optical mineralogy, crystallography, etc.; lectures, laboratory work and theses. *Half Course each Quarter.* Professor COBB.

Laboratory fee, $2.00 fall term; $3.00 winter term.

23-24. Origin and Nature of Soils: field work, laboratory work, and theses. Students in this course are expected to keep Saturday open for field work. Prerequisites, Geology 1-4, Chemistry 1-2 and 31-32, Botany 1-2.

42. Mineral and Ore Deposits: lectures supplemented by laboratory and field work. *Spring Quarter. Half Course.* Professor PRATT.

43. Advanced work in Mineralogy. *Winter Quarter. Half Course.* Professor PRATT.

51-52-53. Advanced Field Work and Special Research in Geology and Geography: problems assigned individually and work adapted to the professional needs of the student. Students in this course are expected to keep Saturday open for field work. *Three full Courses.* Professors COBB and PROUTY.

Courses Primarily for Graduates

104-105-106. Special Research in Geology and Geography: the student is expected to devote six weeks to work in the field, accompanied by the instructor, and to work up his results during the first term of the college year. The entire research constitutes three courses. Professors COBB and PROUTY.

107-108-109. Special Research in economic geology, in historical geology, or in petrology and petrography, two quarters of which must be taken as a seminar course.

DEPARTMENT OF GERMANIC LANGUAGES

WALTER DALLAM TOY, *Professor*
KENT BROWN, *Associate Professor*

The courses for advanced undergraduates and graduates offered by the German Department are designed to meet the needs of three classes of students: those whose interest in language and literature prompts them to pursue their German studies beyond the undergraduate stage; those who are preparing to teach in private schools and private academies; and those who purpose to adopt the study of the Germanic languages as a profession.

For all of these classes the Department offers courses covering different periods of literature. The dialect courses are intended primarily for those who will specialize in Germanic languages.

In view of the great advance made in recent years in our secondary schools, there is an increasing demand for trained teachers. German, it is confidently believed, will soon be established as one of the regular high school studies. It is therefore wise for intending high school teachers interested in German to prepare to teach this language. They should take the Master's degree with German as their major subject.

Such students will first lay a good foundation in their acquaintance with the language, including the power to carry on simple conversation in German, and then extend their acquaintance in the direction both of language and literature as far as time permits.

In the advanced coures which permit of seminary methods, it is possible to discuss the relative merits of different methods of teaching. The members of the teaching staff of the department are ready to direct the private studies of those who are beginning in advance to study the practical problems of the teacher.

For those who will devote themselves to the Germanic languages as a profession the courses offered will serve as a guide in their private work. The Library contains a considerable number of valuable books bearing on Germanic literature and philology. It is hoped that this departmental library will be greatly increased not only by the general appropriations but also by special gifts or bequests such as the May Fund.

Students intending to specialize in the Germanic languages should take the degree of Ph.D.

Courses for Graduates and Advanced Undergraduates

41-42. Goethe's Life and Works. Lectures, reading, reports. Götz von Berlichingen, Werthers Leiden, Tasso, Gedichte, Hermann und Dorothea, Dichtung und Wahrheit. References: Scherer's and Francke's histories of German literature. English and German works on Goethe's life. Junior and Senior elective.

Prerequisite, German 21-22, or 23, or 25-26. *Double Course. Two Quarters.* Professor BROWN.

This course may be elected only after consultation with the instructor.

43-44. Goethe: Faust, Parts I and II. Prerequisite, German 21-22, or 23, or 25-26. *Double Course. Two Quarters.* Professor TOY.

This course may be elected only after consultation with the instructor.

45-46. Kleist and Hebbel. Translation and interpretation of selected dramas; lectures and collateral reading. Junior and Senior elective. Prerequisite, German 21-22, or 23, or 25-26. *Double Course. Two Quarters.* Professor BROWN.

Courses Primarily for Graduates

101, 102. Gothic: Braune's *Gotische Grammatik;* selected parts of Paul's *Grundriss der Germanischen Philologie.* Introduction to Germanic Philology. Prerequisite, German 21-22, or 23, or 25-26. Professor TOY.

103, 104. Old High German: Braune's *Althochdeutsche Grammatik;* Braune's *Althochdeutsches Lesebuch.* Prerequisite, German 21-22, or 23, or 25-26. Professor TOY.

107, 108. Middle High German: Paul's *Mittelhochdeutsche Grammatik;* Bachmann's *Mittelhochdeutsches Lesebuch;* translation into New High German. Prerequisite, German 21-22, or 23, or 25-26. Professor BROWN.

DEPARTMENT OF GREEK

WILLIAM STANLY BERNARD, A.M., *Associate Professor.*

At present the Department of Greek is prepared to offer advanced courses leading only to the degree of Master of Arts. This degree may be achieved in one year of graduate study, preferably two. The department is especially well equipped to offer this degree for work done in New Testament language and literature. It is very desirable that the candidate for this degree should be prepared to pursue courses offered in advanced work by the Department of Latin.

The Department of Greek aims to co-operate with the other departments of language and literature in the University in enabling the advanced student to pursue the broader culture set forth as a function of the Graduate School in paragraph 3, under *General Purpose of the Graduate School* in this catalogue, page 20. To this end courses in English translations of Greek literature are offered, which do not require the ability to read the Greek language. Special emphasis is given to such courses as embrace aspects of the Greek genius: Greek epic, drama, philosophy, art. Such courses may be elected with the approval of the special advisory committee for the applicant.

Library facilities for pursuing these aims are quite adequate. The classical departments have a joint seminar room in which are kept in easy access the libraries of both departments. These libraries contain the standard works of reference, complete sets of the leading philological journals, sets of lantern slides and prints illustrating archaeology, art, drama, etc. The Department of Greek is endowed with a special fund, the Alexander Memorial Fund for the purchase of books.

Courses for Graduates and Advanced Undergraduates

21-22. Greek Drama: An extended reading and study of the Greek drama with lectures on the origin, history and structure of the drama. Prerequisite, Greek 6. *Double Course.* Professor BERNARD.

23-24-25. Greek Drama in English Translations: A course designed to embrace the origin, development, technique and content of the entire Greek Drama, with emphasis on the tragedy as one interpretation of Greek life and thought as a contribution to world progress. Open to Graduates and such Seniors and Juniors as may be admitted by the instructor. *One and a Half Courses. Three Quarters.* Professor BERNARD.

43-44. The Greek New Testament: The Acts of the Apostles, study of grammar and diction, comparison with English versions; the Gospels, with selections from the Epistles; the principles of textual criticism; sources and history of the Greek text and the versions. Professor BERNARD.

61-62. Classical Archaeology: History and Principles of Greek and Roman architecture, sculpture, painting, with some account of the minor arts. Lectures with prescribed reading. Professor BERNARD.

This course is the same as Latin 61-62.

Course Primarily for Graduates

101. Seminar. The critical study of an author or period. During 1920-1921 this study will be directed to the solution of one of the numerous syntactical problems of the language of the New Testament.

THE DEPARTMENT OF HISTORY AND GOVERNMENT

JOSEPH GREGOIRE DEROULHAC HAMILTON } *Professors.*
HENRY MCGILBERT WAGSTAFF }
WILLIAM WHATLEY PIERSON, JR., *Associate Professor.*
FRANK PORTER GRAHAM, *Assistant Professor.*

The resources of the University for graduate instruction by the department make possible the offering of courses under the following heads: History of the Civil War and Reconstruction, constitutional history of the United States, American political theories, Hispanic-American history, international relations, and North Carolina and Southern history.

The Library

The library resources for graduate study in history at the University of North Carolina offer exceptionally rich materials in two fields—those of North Carolina history and the Civil War period. The University has had the good fortune to acquire the Collection of Dr. Stephen B. Weeks, which contains more than 10,000 titles of books, pamphlets, newspapers, and manuscripts relative to the history of North Carolina. This Collection—together with other works possessed by the library, particularly those placed there by the North Carolina Historical Society, and with the manuscripts of the North Carolina Historical Commission, to which the students may have access—must be regarded

by historians as one of the important collections in the United States. The Kenan fund for materials on the Civil War Period has enabled the library to secure a constantly increasing collection, which is especially complete in materials on military history. Recent additions, including a partially complete set of Hansard reports and an important group of books, documents, and pamphlets have been made respectively in English and in Hispanic-American history. The Peabody Collection provides a basis for the study of international law and diplomacy. In the Kidder, Clark, Bridgers, and Howard Collections the University library has a noteworthy group of newspaper materials.

History Seminar Room

The history seminar room, equipped with tables and filing cases, is a repository of important newspaper collections. It is the headquarters for graduate students in history and is situated within easy access to the stacks.

Publications

Under the direction of the North Carolina History Society and under the editorship of certain members of the department, there are published the James Sprunt Historical Publications. Aided by the benefactions of Dr. James Sprunt, of Wilmington, N. C., these publications have reached sixteen volumes. The contents, it may be noted, have in the main been relative to the North Carolina State and colonial history and government, and its pages have been open to students as well as to specialists.

History

Courses for Graduates and Advanced Undergraduates

11-12. Mediaeval Europe. The development of Europe and its civilization from the decline of the Roman Empire to the end of the fifteenth century. Text-books, readings and lectures. Junior and Senior elective. *Fall and Winter Quarters.* Professor WAGSTAFF.

14. Modern Europe. A study of modern and contemporary Europe from the angle of the primary forces that shaped the life

of European nations during the past hundred and fifty years. Text-book, readings and lectures. Junior and Senior elective. *Spring Quarter.* Professor WAGSTAFF.

23. The French Revolution and the Napoleonic Period. A course which deals with the causes—political, intellectual, social and economic—events and results of the French Revolution. Lectures, text-books and readings. Junior and Senior elective. *Spring Quarter.* Professor PIERSON.

28. The Federal Period. American History through the period 1789-1861. Special emphasis in this course is laid upon the struggle of the American people to adjust to the federal principle in the Constitution. Text-books, readings and lectures. Junior and Senior elective. *Winter Quarter.* Professor WAGSTAFF.

29. Civil War and Reconstruction. A course dealing with the more important constitutional, political and economic phases of the period from 1861 to 1876. Lectures, readings and reports. Junior and Senior elective. *Spring Quarter.* Professor HAMILTON.

30. Contemporary American History. A general course dealing with political and social relations in the United States from the close of Reconstruction to the beginning of the World War. Lectures, text-books, and readings. Junior and Senior elective. *Spring Quarter.* Professor PIERSON.

Courses Primarily for Graduates

100-101-102. North Carolina History. A seminar course on the social, economic, and political history of the State of North Carolina. The course continues throughout the year, a weekly conference being held for the presentation of reports and discussions. *One and a Half Courses.* Professor HAMILTON.

103-104-105. Inter-American Relations. A research course concerned with the diplomatic relations of the United States and the Hispanic-American countries. Some particular aspect will be selected for investigation. Prerequisite for this course, History 9-10. Lectures and reports. *Three Quarters. One and a Half Courses.* Professor PIERSON.

Government

Courses for Graduates and Advanced Undergraduates

5-6. The Elements of Political Science. A general course in which a study is made of the principles of political science and of the important theories respecting the nature, origin, forms and ends of the state and of government. An examination of the literature of the subject will be made, supplemented by students' reports on selected political theorists. Lectures, text-books and readings. Junior and Senior elective. *Fall and Winter Quarters. One Course.* Professor PIERSON.

8. The Constitution of the United States. In this course an intensive study will be made of the workings of the American Constitution. The subject will be approached from the legal and constitutional rather than from a political angle. The main body of the work consists in the study and analysis of cases, supplemented by lectures and discussions. Junior and Senior elective. *Fall Quarter.* Professor HAMILTON.

Courses Primarily for Graduates

100-101-102. American Political Theory. A course respecting the political philosophy that has been developed in the United States. A seminar dealing with some selected phase. Lectures and reports. *One and a Half Courses.* Professor PIERSON.

103-104-105. Development of the American Constitution. An inquiry into the sources of the American Constitution and a study of its application and development under changing conditions of the American people. Research in special topics. Lectures, reading and reports. *One and a Half Courses.* Professor WAGSTAFF.

106-107-108. Modern International Relations. A conference course dealing with the history and methods of modern international relations. Special emphasis will be laid upon specified topics, such as modern imperialism, the influence of nationalism, and the movement for international organization. *One and a Half Courses.* Professor HAMILTON.

DEPARTMENT OF LATIN

GEORGE HOWE, *Professor.*

GEORGE KENNETH GRANT HENRY, GUSTAVE ADOLPHUS HARRER, *Assistant Professors.*

CLINTON WALKER KEYES, *Instructor.*

The graduate work of the Department of Latin is planned primarily for the training of teachers, but its course and method are made flexible enough to render it a profitable field of study for purely cultural purposes. In every case it presupposes study of the subject during at least three years of the undergraduate period embracing work in the language and in the literature. Instruction is given through the medium of regular courses of lectures and reading, and of a weekly seminar in which the student is required to do a piece of original investigation. Each student works under the direct supervision of a single instructor, who plans the whole of the major work, gives individual advice in and out of class meetings, and guides and passes upon the thesis submitted for the degree.

A special room in the University Library is set apart for students of the Classics. It is supplied with all the more important editions of the authors, with the standard books of reference in the various branches of the subject, and with sets and current issues of journals in language, literature, archaeology, etc. The Department subscribes for the following periodicals: The Classical Journal, The Classical Weekly, Classical Philology, American Journal of Philology, American Journal of Archaeology, Journal of Hellenic Studies, The Classical Review, The Year's Work in Classical Studies, Hermes, Glotta, Wochenschrift für Klassische Philologie, Jahresbericht der klassischen Altertumswissenschaft, Philologus, Rheinisches Museum, and others. Working tables and cabinets for papers are provided for the convenience of the students.

The degree of Master of Arts is awarded upon the satisfactory completion of a year's work. A student majoring in the subject is expected to devote from one-half to two-thirds of the time to courses in the department and the remainder to courses in closely

allied branches of study. There is no exact prescription of courses except that the seminar is required for all students majoring in Latin; the other courses are determined upon only after the needs of the individual applicant have been discovered.

While knowledge of other foreign languages is not a prerequisite for candidates for the degree, a reading knowledge of French and German will broaden the scope of the work and render it very much more profitable. If preliminary work in Greek has been done, a limited number of courses in that Department may be accepted in lieu of courses in Latin, or Greek may be made the minor subject of study. Courses in Greek literature taught through the medium of English may be prescribed for students who have not had opportunity to study the language.

Courses for Graduates and Advanced Undergraduates

10. Latin Literature in English Translation: lectures and readings. This course is open to students who have no knowledge of the Latin language. *Spring Quarter.* Professor HOWE.

11. Teacher's Course: pronunciation, forms, syntax, prosody, the art of translating, methods of instruction. *Fall Quarter.* Professor HENRY.

12. Roman Historical and Biographical Literature. A study of the structure, purposes, and methods of the most significant works. Translation and readings in English from the literature; reports; lectures. *Fall Quarter.* Professor HARRER.

13. Roman Dramatic Literature: A study of the historical development of Latin comedy and tragedy; reading of selected plays. *Winter Quarter.* Professor HENRY.

14. The Latin Epic: Vergil will be the central theme of this course, but the development of the Latin Epic will be treated historically, and illustrative readings in other poets will be assigned. *Spring Quarter.* Professor HOWE.

19. Cæsar. The political career and literary works of Cæsar will be studied, and selections from the Gallic and Civil Wars will be translated. *Full Quarter.* Professor HARRER.

30. Cicero's Orations. A study of Cicero as statesman and advocate. Selected letters, as well as a number of the orations, will be read. *Winter Quarter.* Dr. KEYES.

(In course 14, 19, and 30 the needs of High School teachers of these authors are considered.)

15. The Beginnings of Prose Fiction. A study of the origins and development of story-writing in ancient times, with emphasis on the novel. Readings from the Greek Romances, Petronius and Apuleius. Knowledge of Greek and Latin not required. *Spring Quarter.* Dr. KEYES.

31. Latin Prose Literature: the course is concerned mainly with the study of the epistolary and historical literature: reading of selected letters from Cicero and Pliny and of passages from Livy, Tacitus and other historians. *Spring Quarter.* Professor HENRY.

Courses Primarily for Graduates

101, 102, 103. Latin Seminar. This course is devoted to the study in detail of particular authors or periods in Roman Literature, the subject matter varying from year to year. It involves wide reading in the Latin authors and in the critical literature concerning them, with oral and written reports by the student. Lectures and conferences. *Three quarters, five hours.* For the year 1920-1921: *Fall Quarter,* Cicero (Dr. KEYES); *Winter Quarter,* Roman Elegiac Poets (Professor HOWE); *Spring Quarter,* Tacitus (Professor HARRER).

104. Latin Epigraphy. The aim of the course is to acquire facility in the deciphering and translating of inscriptions, to study in detail a selection of significant inscriptions and their value in the field of Roman studies. *Fall Quarter, five hours.* Professor HARRER.

105. Latin Paleography. The course will include a study of the more important scripts, practice in decipherment, and the methods of textual criticism. *Winter Quarter, five hours.* Professor HARRER.

DEPARTMENT OF MATHEMATICS

WILLIAM CAIN, ARCHIBALD HENDERSON, *Professors.*
JOHN WAYNE LASLEY, ALLEN WILSON HOBBS, NORMAN M. PAULL,
Assistant Professors.

Opportunities Offered by the Department and by the Field Which It Covers

The subject of mathematics constitutes the foundation upon which the general subject of engineering, in its broader aspects, solidly rests. This is true of such subjects as electrical, chemical, and mining engineering; but more especially, all work in scientific design of structures and in civil engineering depends upon minute and detailed knowledge of mathematical laws and principles.

The material welfare and continuing progress of any state is dependent upon the development of science, and in particular upon the substantial advance of the engineering profession. Since the theory of structures and the science of engineering, in general, have their bases in mathematics, the courses in mathematics for the advanced student are designed, in great measure, to meet such needs. Thus the courses in mathematics are co-ordinated with reference to their application in the practical sciences.

On the pedagogical side, many of the courses, in particular those in pure mathematics, are designed for the student purposing to become a teacher in the schools, or a professor in college or university. In the light of the advance of mathematical science, and the wide ramifications of the more modern branches, many courses are offered, to enable the student to specialize along a number of different lines. A group of consecutive courses permits specialization in the general subject of geometry; another group of courses deals with the broad division of analysis; a third grouping permits a more general course, presenting the basic theories and principles of both geometry and analysis. Courses in mechanics minister primarily to the needs of the student proposing to specialize in some branch of engineering.

The Resources of the Department

In the recently completed Phillips Hall, thoroughly modern in construction and adequate in equipment, are located the departments of Mathematics, Physics, Civil and Electrical Engineering, and Mechanical Drawing. This concentration of allied departments in a single building affords the departments concerned, individually and collectively, striking and exceptional advantages. Capacious lecture halls and small seminar rooms, departmental offices convenient for consultation, well equipped testing rooms and laboratories, and commodious, well-lighted quarters for students in drawing—all are found beneath a single roof. In this building will be a group departmental library, rich in works in mathematics, pure and applied, physics, and engineering, civil and electrical. The mere existence of such a body of collected scientific knowledge, in the atmosphere created by the scientific work in progress in the class-rooms and laboratories, is a powerful stimulus to the developing and promotion of research.

The Requirements for Advanced Degrees

Candidates for the degree of Master of Arts or for the degree of Doctor of Philosophy must meet the requirements laid down in the Bulletin of the Graduate School.

The courses in the major subject are to be selected from the courses enumerated and described below, reference being had to the particular degree sought. The courses may be grouped under the three main divisions: analysis, geometry, and mechanics. The grouping and order of the courses will be arranged by conference between professor and student, the controlling factors being the previous preparation and training of the student and the particular degree sought.

The courses in the minor subject, as a rule, will be chosen from the general fields of the allied and related sciences, such as Physics, Astronomy, and Engineering, civil, electrical, and chemical.

For the candidate for an advanced degree, a working knowledge of French and German is desirable; indeed, in the case of the

candidate for the degree of doctor of philosophy, such familiarity with French and German scientific terminology and facility in the reading of foreign journals, is virtually indispensable. Advanced work in the languages, in special cases, may be done as part of the requirement for the minor subject.

Courses of Study

In the courses "For Graduates and Advanced Undergraduates," enumerated and described below, courses 13-14 (Theory of Equations), 31-32 (Foundations of Geometry), and 5-6 (Descriptive Geometry) do not make prerequisite a knowledge of the calculus. To the taking of all the other courses mentioned, a knowledge of the calculus is prerequisite. In view of these distinctions, complete and thorough courses (numbers 11 and 17) are given annually without exception. The advanced undergraduate specializing in mathematics, as well as the candidate for an advanced degree in mathematics, must certainly, and at least, elect Mathematics 11, in order to take up additional subjects, so large a proportion of which presuppose a working knowledge of the calculus.

Courses for Graduates and Advanced Undergraduates

5-6. Descriptive Geometry: Shades, Shadows, and Elementary Perspective. This course covers treatment of the representation of points, lines, and planes in space, and problems relating thereto; also a brief treatment of single and double curved surfaces and intersections, and development of plane and curved figures. Required of civil engineering students. *Two Quarters.* Assistant Professor PAULL.

11. Calculus—General Course. A thorough drill is given in all processes of integration ordinarily encountered; and also in double and triple integration, with numerous applications to lengths, areas and volumes, employing both rectangular and polar coordinates. Simpson's formulas and the subject of radius of curvature are fully treated. The course is designed to supply a working knowledge of the calculus that will suffice for the engineering student or for a student electing courses 12 or 13-14.

In the case of the student electing course 13-14, additional chapters in evolutes, involutes, and envelopes are to be given. Prerequisite, course 4.

12. Analytic Mechanics. This is a general course in theoretical mechanics, embracing the subjects commonly included under the heads of Statics and Dynamics. The methods of the Calculus are freely employed; and many examples of practical application, especially to engineering problems, are assigned. Prerequisite, course 11. *Fall or Winter or Spring Quarters.* Professor CAIN.

13-14. Theory of Equations. This is an advanced course in the subject. This course is indispensable for students intending to prosecute studies in the higher branches of pure mathematics. Subjects treated are the solution of equations of higher degree, transformations, determinants, elimination, invariants and covariants, symmetric functions, etc. The student is afforded a survey of the general problem and basic principles of the formation, handling, and evolution of equations. Prerequisite, course 4. *Two Quarters.* Professor HENDERSON.

15-16. Differential Equations. This is a course for students intending to specialize in mathematics and for students in advanced engineering, civil, electrical, and chemical. Among the subjects considered are singular solutions, applications to Geometry, Mechanics and Physics, linear equations with both constant and variable coefficients, equations involving more than two variables, partial differential equations, etc. Prerequisite, Mathematics 11-12. *Two Quarters.* Professor HENDERSON.

31-32. The Foundations of Geometry. This course is designed to meet the needs of students, experienced in mathematical thought processes, who wish to lay broad and solid the basis of their knowledge of geometry. A survey of the contributions of Pasch, Peano, Hilbert and their school, to our knowledge of the foundations of geometry, a study of the axioms and of the formation of systems of geometry, etc. *Two Quarters.* Professor HENDERSON.

17-18. Advanced Differential and Integral Calculus. This course completes and rounds out the subject as given in Mathematics 11. Rigor in demonstration is insisted upon. The course will be designed to meet the particular needs of the class—for

example, largely a problem course, or a special study of complex functions, elliptic functions, etc. A thorough knowledge of the calculus is aimed at in this course. Prerequisite, Mathematics 11-12. *Two Quarters.* Professor CAIN.

Courses Primarily for Graduates

119, 120. Vector Analysis. All the fundamental topics of vector analysis are given in this course. The subject is now being introduced into treatises on the calculus; and hence it is desirable for the graduate student to include it in his general course in the higher mathematics. Because of the brevity and elegance of the demonstrations, the analysis employed is especially useful to the student in the higher physics, civil and electrical engineering. Prerequisite, Mathematics 11-12. *Two Quarters.* Professor CAIN.

121, 122. Modern Synthetic Geometry. This course constitutes an introduction to the study of geometry from the projective standpoint. It is a profitable subject of study both for the civil engineer and the professional draughtsman. While geometry is here studied from the synthetic standpoint, the contact with analytic treatment and methods is concurrently afforded. Prerequisite, Mathematics 11-12. *Two Quarters.* Professor HENDERSON.

123, 124. Modern Analytic Geometry. This course, outlining the principal modern methods, in the analytic treatment of geometry, supplements and greatly extends the introduction to the subject, embodied in Mathematics 3. Indispensable to candidates for a post-graduate degree in the higher mathematics. Deals with the principle of duality, transformation, descriptive properties of curves, curve training, cross-ratio; homography, involution, theory of correspondence, invariants, covariants, etc. Prerequisite, Mathematics 11-12. *Two Quarters.* Professor HENDERSON.

125, 126. Analytic Geometry of Space. A course treating of the spatial relations from the analytic standpoint. Indispensable to the student of the higher mathematics. Treats of the conicoids, envelopes, foci, quadriplanar and tetrapedral co-ordinates, devel-

opable surfaces, curves, curvature of surfaces, etc. Prerequisite, Mathematics 11-12. *Two Quarters.* Profesor HENDERSON.

127, 128. Elementary Analysis. The course begins with a study of the theory of a real variable, dealing briefly with the Dedekind-Canton theory of irrationals as defined by partitions, sequences, sets, and series, the Fourier series, and power series. The second quarter will be devoted to a study of functions of a complex variable, in particular functions fulfilling the Cauchy-Riemann condition, mapping, transformations, the Riemann surface, etc. Indispensable to a student desiring to gain a notion of the essentials of modern mathematical thinking. Prerequisite, Mathematics 17-18. *Two Quarters.* Assistant Professor LASLEY.

129, 130. Advanced Analytic Mechanics. An extended course in the subject, supplementary to course 12. A thorough treatment is given of Kinetics and Kinematics. In addition, fundamental theorems in hydrostatics and hydro-kinetics are treated in detail. Prerequisite, Mathematics 11-12. *One Quarter.* Professor CAIN.

DEPARTMENT OF PHILOSOPHY

HENRY HORACE WILLIAMS, *Professor.*

Courses for Graduates and Advanced Undergraduates

10-11-12. This is a course in Logic that runs through the year, meeting three times a week. The work may appeal to one who desires to know what the thinking process is. This course lays the basis for work in philosophy.

16-17-18. This course will appeal to one who desires to consider the fundamentals in our life. The problem of the "Sacred Book," the problem of the miracle, the problem of the state are questions studied. This course runs through the year, meeting three times a week.

19-20-21. This is a companion course to 16-18. It limits its work to the problems belonging to the Christian civilization. The course runs through the year, meeting three times a week. In each of these courses the student is expected to undertake to understand for himself some fundamental problem, and to incorporate his findings in a thesis.

DEPARTMENT OF PHYSICS

ANDREW HENRY PATTERSON, *Professor.*
HARRY MORRISON SHARP, *Instructor.*

The importance of a thorough course in physics becomes greater each year. Not only is a good knowledge of the subject required for admission to medical, dental and technical courses of all kinds, but there is a growing demand for trained physicists in the government agencies, such as the Bureau of Standards, the Meteorological Service, etc. In addition, there is a need in the testing laboratories of the larger corporations for physicists of ability and training, and a constant demand for them in the teaching profession.

It is the aim of the department here to present the subject of physics in its modern aspect with sincerity and thoroughness, giving at the same time plenty of work in the laboratories, and affording facilities for research along various lines. The experiments given in the courses are carefully chosen, and the apparatus is new and capable of considerable precision.

Phillips Hall

The removal of the department to its new quarters means the possibility of great expansion along all lines in the future. Phillips Hall is a three-story reinforced concrete building, 182 feet long and 74 feet in depth, built in the Tudor Gothic style, and entirely fireproof. The walls are of tapestry brick, with limestone trim.

The rooms assigned to the Physics Department are the general laboratory, 32 x 74 feet, an advanced laboratory, a magnetic laboratory, an auditorium with a capacity of 300, a room for smaller classes, together with apparatus rooms and offices, and a department library which is endowed by Mr. Isaac Emerson, of Baltimore, and possesses many of the best modern books on physics as well as complete files of the leading journals. Besides these rooms the department has the right to use the general workshop, research rooms, etc., and to visit and make use of the rooms and resources of the engineering laboratories, drawing rooms, etc.

Courses for Graduates and Advanced Undergraduates

5. Heat and Thermodynamics. Lectures, problems and laboratory work, based on Edser's Heat for Advanced Students. Prerequisite, Physics 1 and 2. Mr. SHARP.

7. Modern Electrical Theory. The electron theory, electric waves, atomic structure, thermionics, radioactivity and other subjects bearing on the subject of the constitution of matter. Lectures, recitations and laboratory work. Prerequisite, Physics 1 and 2. Professor PATTERSON.

9. Optics. A treatment of the fundamental principles of geometrical and physical optics. Lectures and laboratory work. Prerequisite, Physics 1 and 2. Mr. SHARP.

Course Primarily for Graduates

115. Modern Progress in Physics. A course continuing Physics 7, and covering the development of physics since 1896, especially along the lines of theories of atomic structure, positive rays, X-rays, relativity, gravitation, and electrical oscillations. Lectures, conferences, and work in the laboratory. Reports on assigned subjects, with constant reference to the journals. Prerequisite, Physics 1, 2 and 7. Professor PATTERSON.

DEPARTMENT OF PSYCHOLOGY

J. F. DASHIELL, *Associate Professor*

The work of the department of psychology, past and present, falls primarily within the limits of the campus. The demand on the part of many other fields for reliable knowledge of human nature, especially in various professional schools, amounts to a call for co-operation from the psychological department; and instruction and research in psychology are shaped with a view to supplying such assistance to education, commerce, medicine, sociology, etc. The heart of the work, however, is along the lines of interest in psychology for its own sake; and students who are interested in the subject as an independent science are given opportunity and co-operation in research. Natural extensions of

this campus work are found in mentality examination of children in co-operation with school authorities, and in approaches to the vast field of industrial personnel in co-operation with manufacturing or mercantile firms.

The courses listed for graduates are selected with the aim of providing those that will be intensive without being too narrow. Such courses are naturally to be recommended to those majoring in another department, as well as the fittest for those who wish to give themselves a thorough and sound purchase on psychology as their major subject. A sufficient number are offered to provide an ample year's work for the student interested in a Master's degree in psychology. The research work will ordinarily be done in connection with the course in Experimental Psychology and the Seminar.

Courses Primarily for Graduates

101, 102, 103. Experimental Psychology. Opportunity will be offered for the experimental investigation of special problems along the line of the individual student's interests. Where necessary, adjustment of the work to the needs of graduate students lacking laboratory training in this field can be made. *Half or Full Courses,* five or ten laboratory hours weekly. *Fall, Winter, and Spring Quarters.*

105. The Psychology of James. An intensive reading of James' "Principles of Psychology" (2 volumes), as the great psychological classic, with discussions in terms of alternative interpretations. *Fall Quarter.*

106. Contemporary Psychological Tendencies. A more or less systematic survey of the more outstanding recent and contemporary movements in modern psychology. Readings assigned in the works of Wundt and Titchener, Hall, McDougall and Stout, Thorndike, Pavlov, Watson, Cannon, Freud and Jung, and perhaps others. *Winter Quarter.*

107. The Psychology of Training. An analysis of human training: its nature, means, and possibilities. A reading survey will be made of the outstanding experimental work on these lines. The aim will be to get an accurate and scientific notion of the subject,

with possibilities of application to various fields of applied psychology, including education and industry. *Half Course. Spring Quarter.*

108. Seminar. The general subjects will be chosen at the beginning of the quarter, and in view of the special interests of the students. The work will consist of papers by the members of the class, and free discussions. Opportunity will be given for the preliminary reporting of investigations students may have in progress and for helpful discussion thereof. *Half Course. Spring Quarter.*

DEPARTMENT OF ROMANCE LANGUAGES

WILLIAM MORTON DEY, *Professor.*

OLIVER TOWLES, STURGIS ELLENO LEAVITT, *Associate Professors.*

The Department of Romance Languages offers advanced courses leading to the degree of Master of Arts. Its collection of books in the Romance Seminary Room in the University Library contains a fair amount of material for graduate courses in French literature. In Old French philology and literature the facilities are increasing, especially in collections of texts. The Library carries subscriptions for the leading journals devoted to Romance literature and philology, such as *Romania, Zeitschrift für romanische philologie, Revue d'histoire littéraire de la France, Romanic Review, Revue hispanique, Modern Philology,* and *Publications of the Modern Language Association of America.*

Requirements for the Degree of Master of Arts

The general requirements for the degree are stated elsewhere in this Bulletin. The special requirements in Romance Languages are as follows:

(a) A knowledge of Latin is required, and a reading knowledge of German is most desirable, as preparation for the graduate courses offered.

(b) Preliminary Courses: to become a candidate for the degree, the student must have passed satisfactorily Courses 1-6 (see general catalogue of the University), and must have an acquaintance with French literature equivalent to Course 15-16.

(c) Courses leading to the Degree: Not less than nine courses must be taken in residence at this University, at least six of which must be in the field of Romance Languages.

Courses for Graduates and Advanced Undergraduates

15-16. French Literature in the Nineteenth Century. Romanticism: Lamartine, Hugo, Vigny, Musset, etc., and later literary movements. Lectures, reading, reports. *Winter and Spring Quarters.* Professor DEY.

17-18. The French Drama. A study of the development of the drama in France. Lectures, reading, and much collateral reading, with reports. *Fall and Winter Quarters.* Professor TOWLES.

Courses Primarily for Graduates

101-102. French Classicism. The development of French classic ideals and doctrines. French classic writers, including Malherbe, Pascal, Corneille, Racine, Molière, etc., and the principal writers of the eighteenth century. *Fall and Winter Quarters.* Professor LEAVITT.

105-106. The Sixteenth Century. Origins of the Renaissance movement: Italian and French Humanism. The Reformation. Marot, Rabelais, Calvin, the Pléiade, Montaigne. *Winter and Spring Quarters.* Professor TOWLES.

109-110. The Development of the French Novel. (Not given in 1920-1921.) Professor DEY.

121. Old French. Reading of the oldest texts: La Chanson de Roland; Aucassin et Nicolette; Chrétien de Troyes. Lectures on French Phonology and Morphology. *Fall Quarter.* Professor TOWLES.

125. Provencal. A study of the ancient language and literature of Provence. The poetry of the Troubadours. *Spring Quarter.* Professor DEY.

130. Research in a special field under the direction of a member of the Department.

DEPARTMENT OF RURAL SOCIAL SCIENCE

E. C. BRANSON, *Professor.*
S. H. HOBBS, JR., *Assistant Professor.*

1. The work offered to graduate students by the Department of Rural Social Science is a formal response on the part of the University to the state-wide demand for direct schooling in matters of competent citizenship and effective public service in rural areas. It concerns the problems of country wealth and welfare—the problems of 80 percent of the population of North Carolina and the South. The activities of the department look two ways: into great fields of learning on the one hand, and on the other into concrete social situations—into the puzzles of life and livelihood in our country regions.

2. During the last six years the graduate students registering for these courses have been (1) teachers who aspire to leadership in community affairs as well as teachership in community schoolhouses, (2) preachers of various religious faiths, who have widening visions of ministry in country and village pastorates, and (3) young men who have become aware of the steadily increasing demand for teachers of rural social science in the country high schools, the teacher training schools, the land grant colleges, and the church colleges and seminaries. Since the report of the Federal Country Life Commission in 1909 more than a hundred schools of liberal learning, technical arts, and professional training have established courses in rural economics and sociology, and the number increases daily.

3. The courses in rural social science offered by the University of North Carolina are in the way of rapid development. Its graduate work in this field responds sensitively (1) to the demands of the social workers created by the thirty-five public welfare laws recently passed by our legislature, and (2) to the rural economic and social research plans and policies that are now being developed by the Federal Department of Agriculture. The state experiment stations and agricultural colleges of the country are calling for trained research workers in rural fields, and for teachers of rural social science subjects. The state is calling for trained

social organizers and field agents in a hundred counties. And they ought to be public servants with a competent grasp of social subjects and an effective grip upon social situations and problems.

The seminar room of the department is an extensive rural social science library. There is probably no better in the United States. It is rarely well equipped with the literature of its special field of learning, with current reports, bulletins, pamphlets, journals, magazine and newspaper clippings, and the like. It is also a clearing house of information about North Carolina, economic, social, and civic—rural, industrial, and urban.

Courses for Graduates and Advanced Undergraduates

1. Rural economics: research, seminars, and field investigations in (1) land economics—resources, values, ownership and tenancy, laws and policies; (2) farm organization and management—farm systems, farm finance, distribution of farm products and the farm income, co-operative farm enterprise; (3) country wealth and country institutions, country home comforts and conveniences, etc.; (4) state and county studies, economic, social and civic; county bulletins, etc. Required preliminary preparation: approved courses in general and agricultural economics. Lacking such preparation, collateral courses in these subjects must be taken in residence here.

2. Rural Social Problems: 1. Research, seminars, and field investigations of (1) rural social institutions and agencies, (2) transportation and communication facilities in rural areas, (3) country-mindedness and its sequences, (4) town and country interdependencies, (5) social disability in country areas, our public welfare laws and agencies, (6) social aspects of tenancy and illiteracy, (7) state and county studies, economic, social, and civic; county bulletins, etc. 2. Rural Social Surveys: research, technic and field work. 3. Statistics: interpretation and use. 4. Rural Social Engineering: (1) country community studies; (2) community organization, economic and social; (3) county government; (4) country leadership, requisites and technic. Required preliminary preparation: approved courses in general and rural sociology, lacking which, collateral courses in these subjects must be taken in residence here.

DEPARTMENT OF ZOOLOGY

HENRY VAN PETERS WILSON, *Professor.*

Those who find themselves strongly interested in zoology will meet with opportunities for teaching and investigating in several of the subdivisions of present-day universities, such as college, technological, medical, and graduate school. Others will find their best opportunity, especially if their interest centres round the fundamental problems of cellular biology, in research institutions of a more or less medical character. Museums need the services of many zoologists as curators. Such persons are expected to acquire intimate and extensive knowledge of the classification and natural history of some particular group. Somewhat the same kind of specialization is demanded of those who are drawn into institutions for the betterment of public health, some concentrating on the study of protozoa, others on the insects that spread disease, others on the parasitic worms, etc. There is, finally, much work of an economic nature that is carried on by zoologists in the service of national and state bureaus, such as the U. S. Bureau of Fisheries and the several bureaus under the U. S. Department of Agriculture.

The department occupies, along with the department of Botany, the Biological Building known as Davie Hall, a description of which is contained in the University Catalogue. The equipment of the department in books, journals, collections, and instruments will be found adequate to the needs of much graduate work. Opportunity to carry on investigations at the seaside may usually be obtained during the summer at the Biological Station of the U. S. Bureau of Fisheries situated at Beaufort, N. C.

The courses listed below are such as lead more especially to the Master's degree (M.A. or M.S.). For the Ph.D. degree the essential requirement is that the candidate shall have such a grasp of the concepts and methods of zoology as will enable him independently to acquire knowledge of some importance that is new to science. This depends not only on manipulative skill and experience but also on ability to handle the literature of the subject, the treatises, hand-books, and especially the current journals. A reading knowledge of French and German is necessary.

Courses for Graduates and Advanced Undergraduates

3. Comparative Anatomy of Vertebrates: dissection of types, especially amphioxus, petromyzon, fish, fowl, rabbit. Laboratory work with occasional lectures. *Fall Quarter.*

4. Comparative Embryology of Vertebrates: maturation and fertilization phenomena in some invertebrate types; segmentation and formation of germ layers in frog and teleost fish; germ layers and development of characteristic vertebrate organs in chick; fundamentals of microscopic technique. Laboratory work with occasional lectures. *Winter Quarter.*

5. Comparative Histology of Vertebrates: microscopic preparations of selected tissues and organs are made from the fresh animal, and studied with the help of texts. Laboratory work with assigned reading. Prerequisite, Zoology 4. *Spring Quarter.*

6-7-8. Morphology and classification of the Invertebrates: dissection and microscopic study of types of the chief orders, with some consideration of life-histories; systematic diagnosis. Laboratory work with occasional lectures. *One and a Half Courses. Fall, Winter, and Spring Quarters.*

Courses for Graduate Students

109, 110, 111. Embryology and Regeneration in the lower metazoa and simpler vertebrates. *Triple Course. Fall, Winter, and Spring Quarters.*